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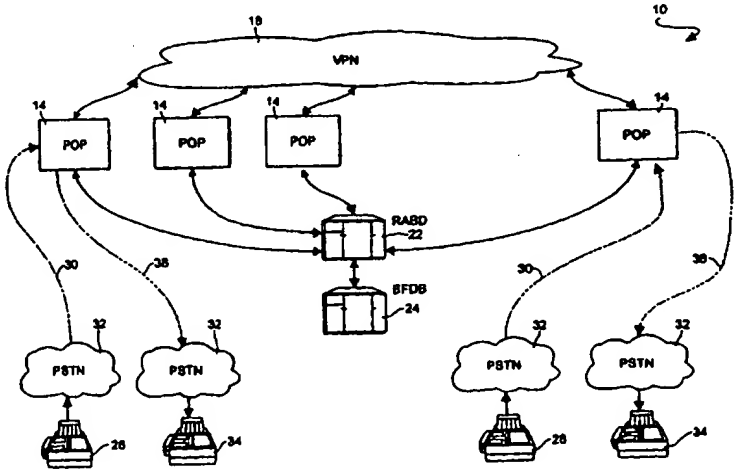

(57) Abstract

The present invention provides a process and system for transmitting long distance facsimiles which provides a subscriber with a lowered cost facsimile transmission, comprising: a plurality of points of presence; a virtual private network; a routing and authorization processing means; and a billing and financial processing means; wherein a plurality of sending facsimile machines and a plurality of receiving facsimile machines are connectable to any of the plurality of points of presence and wherein the user transmits a facsimile with a signaling means via the sending facsimile machine to the point of presence; the point of presence interpreting data in the signaling means and passing the data to the routing and authorization processing means; the routing and authorization database authorizing and routing the facsimile and passing billing data to the billing and financial processing means and wherein upon receiving routing and authorization, the point of presence routes the facsimile via the virtual private network to the destination facsimile machine.

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DATA TRANSMISSION SYSTEM AND PROCESS FOR TRANSMITTING FACSIMILES

FIELD OF THE INVENTION

The present invention relates to facsimile transmission routing systems and more specifically, the present invention relates to a facsimile data transmission system and process which optimizes transmission routing for either long distance cost savings or delivery urgency considerations without the requirement of any special hardware connected to the sender's facsimile machine.

DESCRIPTION OF THE PRIOR ART

Facsimile transmission systems are known. In the past these systems, which were primarily directed at the long distance market, were established with the hope of attracting customers by offering a cost saving alternative over direct long distance dialing. Typically upon subscription to the transmission service, the sender is provided with a "black box" which is installed on the facsimile line between the facsimile machine and the telephone line.

The electronic transmission of documents by way of facsimile systems employing both public and private telephone networks has become common place. Faxing is now an essential component in many business activities. Facsimile messages are generally sent via an apparent direct telephone link from the sender's facsimile machine to a receiving facsimile machine. The receiving facsimile machine may be a personal machine or a central terminal where messages are sorted and redistributed to the correct destination.

One of the major concerns in facsimile transmission today is

security. Many facsimile documents are of a sensitive nature and it is desirable that the sender and/or the recipient have some measure of control over the ease with which a third party can "break into" a faxed document. At present, the most common way to ensure some measure of security is to transmit documents between facsimile machines over a dedicated line, i.e., one that is not part of the public telephone network. Dedicated lines are expensive and, obviously, do not allow any flexibility in the routing of a document. Another approach to securing transmission is the use of "mailbox" functions whereby, instead of received facsimiles being immediately printed out at the destination machine and open to public inspection, the received facsimiles are stored in an electronic mailbox and can only be retrieved by a recipient having the security code to enter the mailbox (conventionally a Personal Identification Number (PIN)). This option aids in the prevention of "break-ins" at the destination point, but does nothing to prevent a third party tapping into the telephone lines during transmission of the facsimile.

One of the other disadvantages of most present facsimile systems is that facsimile messages are generally sent over the most direct telecommunication lines available at the time of sending. This apparent direct connection is not always the cheapest connection available, especially if the facsimile being transmitted is not necessarily of an urgent nature. A "time delay" transmission option is available on many facsimile systems. This "time delay" option allows a sender to select a convenient time to send the facsimile document when telephone rates are at their lowest. This is a particularly useful feature when long distance/international calls have to be placed and economy is at a premium. Unfortunately, even using a "time delay" transmission, the sending facsimile machine is generally connected to the receiver via the most direct lines available, these not necessarily being the most economical.

Facsimile transmission systems which attempt to overcome some of the problems of the apparent direct link are known in the art.

United States Patent No. 4,994,926 to Gordon et al. discloses a facsimile telecommunication system, compatible with existing facsimile terminal machines, which provides a computer-based facsimile store and forward facility (SAFF) as an integral part of a switched telephone network system. All facsimile transmission entered onto the network are routed to a SAFF which is typically located in the general geographical area of the originating machine. The transmissions are temporarily stored at the SAFF in a mass storage media. A subscriber to the system sends an outgoing facsimile message to the SAFF with which it is associated. The SAFF records the facsimile message together with data as to originating facsimile machine and destination facsimile machine. The SAFF facility then delivers the facsimile message to the intended receiving facsimile machine, either directly or through another SAFF facility. If unsuccessful on initial attempt, the SAFF periodically retries to send the facsimile message.

In the system of Gordon et al., each subscriber is assigned a mailbox on their local SAFF. Destination (outgoing) facsimiles are stored in the mailbox and the subscriber may periodically access the mailbox using a PIN number to receive waiting facsimiles or redirect stored facsimiles to another destination.

Gordon et al. further discloses that the system may be provided with a facsimile to a voice message conversion system, which converts inbound facsimile messages to voice mail messages which are stored in destination voice mailboxes. Gordon et al. further disclose a process of establishing connections

between SAFFs where an inbound control unit imposes an algorithm on each incoming facsimile document which examines the destination numbering and the available telephone trunk line resources and chooses the most efficient combination of these lines for routing the facsimile.

United States Patent No. 4,941,170 to Herbst discloses a facsimile transmission system to transmit documents over telephone lines using an electronic mail system. The electronic mail system may be localized or distributed. Transmission is initiated by the sending facsimile machine transmitting a mark sense cover sheet, which has a mark sense identifier printed on it, to a facsimile controller. The facsimile controller checks for the presence of the mark sense identifier and, if present, the controller reading the identifying information and destination address coded thereon. The controller then transmits the identifying information and destination address and the subsequently received document facsimile data to the electronic mail system in digital form, for retransmissions back through the same or a different controller to one or more receiving facsimile machines.

United States Patent No. 5,287,199 to Zoccolillo discloses a facsimile message processing and routing system in which a processor, connected to a communications switching system, intercepts each facsimile message destined for a receiving party. The processor analyzes at least a portion of each intercepted message to collect routing information and call number. The processor then delivers the message to at least one of a plurality of other destination facsimile terminals, based on the routing information gathered from the message and prearranged routing information stored in the processor and provided by the receiving party.

United States Patent No. 5,291,546 to Giler et al. discloses a facsimile message delivery system in which messages sent over a telephone system are subjected to prespecified actions at a facsimile receiving station. The sender initiates a call to the facsimile receiving station by dialing a telephone number which is sufficient to route the telephone call to the facsimile receiving station and which is also sufficient to determine the prespecified actions to which the facsimile message is to be subjected at the receiving end. The telephone number is carried through the telephone system in the form of an address signal as part of the call initiation process. The facsimile receiving station has information stored thereon which associates with each possible incoming telephone address signal, a prespecified action to be taken with respect to that call. The facsimile receiving station uses the stored information to determine what actions should be taken for the incoming message. Once received, the incoming message is handled in accordance with the prespecified action.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a novel facsimile transmission process and system which obviates or mitigates at least one of the disadvantages of the prior art facsimile transmission systems.

According to one aspect of the present invention, there is provided a facsimile network system for providing a subscriber with a lowered cost facsimile transmission, comprising: a plurality of points of presence; a virtual private network; a routing and authorization processing means; and a billing and financial processing means; wherein a plurality of sending facsimile machines and a plurality of receiving facsimile machines are connectable to any of the plurality of points of presence and wherein the user transmits a facsimile with

a signaling means via the sending facsimile machine to the point of presence; the point of presence interpreting data in the signaling means and passing the data to the routing and authorization processing means; the routing and authorization database authorizing and routing the facsimile and passing billing data to the billing and financial processing means and wherein upon receiving routing and authorization, the point of presence routes the facsimile via the virtual private network to the destination facsimile machine.

According to another aspect of the present invention there is provided a process for transmitting a long distance facsimile at a lowered cost to a subscriber over a facsimile transmission network comprising the steps of: the subscriber sending a facsimile with a signaling means to at least one of a plurality of points of presence; the at least one point of presence processing the signaling means and transmitting the processed signaling means to a routing and authorization processing means; the routing and authorization processing means authorizing and routing the facsimile; returned the routing and authorization of the facsimile to the at least one point of presence; and the at least one point of presence routing the facsimile via a virtual private network to the destination.

Preferably, a billing and financial processing means records data relevant to the facsimile transmission for billing the customer.

Also preferably, the point of presence includes an encryption means for encrypting the facsimile prior to routing and a decryption means for decrypting the facsimile prior to arriving at the destination.

Also preferably, the point of presence includes a compression

means for compressing the facsimile for transmission via the virtual private network, to the destination.

Also preferably, the virtual private network includes at least one communication connection to a call-back service.

Also preferably, the virtual private network includes at least one T1 and/or a T3 type communication connection to a publicly switched telephone network.

Also preferably, the virtual private network includes at least one communication connection for transmission of facsimiles via an internet connection.

Also preferably, the virtual private network includes at least one Publicly Switched Telephone Network (PSTN) connection for transmission of facsimiles.

Also preferably, the virtual private network includes at least one Integrated Services Digital Network (ISDN) connection for transmission of facsimiles.

Also preferably, the routing and authorization processing means optimizes routes based on minimal cost routing.

Also preferably, the routing and authorization processing means optimizes the routing of the facsimile transmission for timeliness of delivery.

Also preferably, the billing and financial processing means stores a routing policy object which defines a set of rules for which the routing and authorization processing means optimizes routing.

Also preferably the transmission of the facsimile to the destination is confirmed to the subscriber by the network.

Also preferably, the facsimile transmission system provides a subscriber with a plurality of customized billing and reporting options for verification of facsimiles sent via the system over predetermined period of time.

Also preferably, the facsimile transmission system includes a station to person service wherein a subscriber sends the facsimile to the system and their receiver can receive the facsimile from a preselected source other than their destination facsimile machine.

Also preferably, the facsimile transmission system includes an auditing means whereby a subscriber is capable of verifying facsimiles sent to the system via sending facsimile machine against the facsimiles transmitted by the system.

Also preferably, the signaling means identifies subscriber and destination data to the system.

Also preferably, the signaling means is in a format that is both readable by the subscriber and by the system.

Also preferably, a keypage is employed to identify subscriber and

destination data to the system.

Also preferably, the data entered onto the keypage is in a format that is both readable by the subscriber and by the system.

Also preferably, the data entered onto the keypage is in the format of a plurality of boxes placed at a predefined location and corresponding to alpha-numeric data and wherein the subscriber enters data readable by both the subscriber and the system by shading in the appropriate boxes.

Also preferably, the keypage includes an authorization code which the subscriber is required to enter and for which the routing and authorization processing means employ for authorization purposes.

Also preferably, the keypage includes a predefined time interval after which the keypage expires and is unusable by the subscriber.

Also preferably, the facsimile transmission network includes means to multi-cast a facsimile transmission wherein a subscriber is capable of sending one facsimile to a plurality of known destination facsimile machines.

Also preferably, the facsimile transmission system includes a broadcasting means wherein the subscriber is permitted to send the facsimile from the sending facsimile machine via the system to a plurality of unknown destination facsimile machines.

An advantage of the facsimile transmission system of the present invention is that a subscriber is only required to dial a single predefined number

each time they wish send a long distance facsimile. The predefined number connects the sender facsimile machine to a point of predefined point of presence determined upon subscription to the service by the subscriber.

A further advantage of the present invention is that the subscriber can pre-program the sender facsimile machine with the number of the point of presence by means of a speed dial button, enabling connection to the system by pressing a single button.

A further advantage of the present invention is that the subscriber is enabled to transmit long distance facsimiles to a destination facsimile machine via their sending facsimile machine at a cost which is less than or equal to the equivalent cost of sending the facsimile by dialing directly.

A further advantage of the present invention is that the facsimile transmission system is designed and optimized to handle data relating to facsimile transmissions in contrast to a plurality of data types and protocols, thereby operating in an efficient low-cost manner.

BRIEF DESCRIPTION OF THE DRAWINGS

A presently preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a structural representation of a facsimile transmission system in accordance with an embodiment of the present invention;

Figure 2 shows a structural representation of a point of presence (POP) in accordance with the embodiment of Figure 1;

Figure 3a shows a signaling means in the form of a keypage in accordance with the embodiment of Figure 1;

Figure 3b shows an alternative signaling means keypage having an alternative input means;

Figure 4 shows the system of Figure 1 as defined by areas of functional responsibility for a routing and authorization processing means and a billing and financial processing means;

Figure 5a shows a partial process for transmitting a facsimile via system 10 in accordance with the embodiment of Figure 1;

Figure 5b shows a continuation of the process of Figure a for transmitting a facsimile via system 10 in accordance with the embodiment of Figure 1; and,

Figure 5c shows a continuation of the process of Figure 5b for transmitting a facsimile via system 10 in accordance with the embodiment of Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A facsimile transmission system in accordance with the present invention is indicated generally at 10 in Figure 1. System 10 is established for

the purpose of providing a long distance facsimile transmission service to a plurality of subscribers. System 10 offers as a low cost alternative to the conventional method of sending long distance facsimiles whereby a direct connection between a transmitting and a receiving facsimile machine is established. As shown in the Figure, system 10 generally comprises a plurality of Points of Presence (POP)s 14, a Virtual Private Network (VPN) 18, a Routing/Authorization Database (RADB) 22, and a Billing and Financial Database (BFDB) 24. A plurality of input means such as Sender Facsimile Machines (SFM)s 26 attaches to system 10 at any one of the plurality of POPs 14 via a communications line 30. Similarly, a plurality output means such as Destination Facsimile Machines (DFM)s 34 are connected to any one of the plurality of POPs 14 via a conventional telephone line 38 operating on a conventional Publicly Switched Telephone Network (PSTN) 32.

Typically, SFMs 26 and DFMs 34 may be any conventional facsimile machines or a facsimile modem connected to a conventional personal computer operating facsimile software. As should be apparent to those of skill in the art, any facsimile machine can serve as both an SFM 28 or DFM 34. However, for the purposes of this discussion, they are differentiated to delineate the functions of sending and receiving. As shown in Figure 1, SFM 28 represent a plurality of facsimile machines which may be connected to system 10. Furthermore, respectively, SFMs 28 and DFMs 34 also represent a plurality of subscribers wishing to transmit a long distance facsimile and individuals receiving a facsimile via system 10. In reality, the present inventors contemplate that system 10 is suitable for deployment on a worldwide scale effectively offering a low cost alternative for long distance facsimile transmission anywhere in the world. Therefore, with this in mind, it is realistic to assume that several hundred thousand SFMs 26 and DFMs 34 could be

connected to system 10 at any given time. The connection of SFMs 26 and DFMs 34 via communication lines 30,38 respectively is not necessarily a permanent connection but is typically of a temporary nature. Generally speaking, communication with system 10 is only established when a subscriber wishes to transmit a facsimile using an SFM 28 or, system 10 is required to transmit a facsimile to one or more DFMs 34.

The plurality of POPs 14 represent connection points where SFMs 28 connect to system 10 and through which system 10 connects to the DFM 34 for final delivery of the facsimile to its destination. As previously indicated, POP 14 is a "point of presence" of system 10 which allows for the connection of subscribers to the long distance facsimile service. For example, when a subscriber wishes to send a long distance facsimile via system 10, the subscriber programs SFM 28 to a dial a predetermined number of a POP 14 assigned to the subscriber. System 10 then routes the facsimile via VPN 18 in the most cost effective or time conscious manner to the destination facsimile number specified by the subscriber. The advantage in subscribing to system 10 is that a subscriber can save on long distance transmissions when compared to placing a direct facsimile to facsimile long distance call by having system 10 pass along a percentage of the cost savings to the subscriber. Other features and advantages of system 10 will be described in greater detail below.

The advantage of dialing system 10 each time the subscriber wishes to send a long distance facsimile is that the subscriber dials the same number every time or simply presses a preprogrammed speed-dial button to initiate the transmission. Consequently, the requirement of dialing long distance indicators, country codes and area codes in addition to the destination facsimile number is eliminated, thereby eliminating the possibility of dialing errors occurring.

For the purposes of this discussion, the plurality of POPs 14 can be characterized and described with respect to three functional roles which they are capable of assuming depending on their relationship to a given facsimile transmission. Specifically, the terminology is noted as follows: Forwarding POP (FPOP) indicates a POP 14 which receives a facsimile from SFM 28 for forwarding through system 10; Intermediate POP (IPOP) indicates a POP 14 which is placed in the routing path of the facsimile transmission and acts as a repeater; and, Destination POP (DPOP) indicates a POP 14 which is the final location in the routing path prior to transmitting the facsimile to RFM 34. The above defined terminology will hereinafter be used interchangeably when referencing POP 14 depending on the context of the discussion.

In most instances, the connection of SFM 28 to FPOP 14 would be established over communication lines 30 which employs a conventional telephone line operating on a PSTN. Using this type of communication, the facsimile transmission to FPOP 14 would be typically transmitted as an analog signal in a conventional manner.

Typically the predetermined number and FPOP 14 location are assigned to the subscriber upon subscription to the service. The decision of which of the plurality of FPOPs 14 the subscriber will connect with is determined by system 10 and is typically based on, but not limited to, geographic proximity to the subscriber. However, in many situations, especially during the initial deployment of system 10 on a worldwide scale, the closest FPOP 14 may also involve a long distance call, the cost of which, the subscriber absorbs. To alleviate this concern and make the present system more attractive as a low cost alternative for long distance facsimile transmission, the subscriber may be provided with the number of a call back service.

For example, in some situations where SFM 28 is located geographically distant from FPOP 14, it may not be cost effective to transmit via communication lines 30 using the conventional approach. The call-back service connects directly the most cost effective FPOP 14 location on system 10 with respect to the geographic subscriber location. The subscriber calls the call-back service waits for one ring and then disconnects. The call-back service then calls the subscriber back by employing the most cost effective routing for the call. Once the subscriber answers the call, they then transmits the facsimile to FPOP 14. For example, typically, long distance rates in Japan for telephonic communication within the country are more costly than placing a long distance call from New York City to a city in Japan. Therefore, it may be prohibitive for a subscriber in Osaka, wishing to send a long distance facsimile to Europe to first send the facsimile to the closest FPOP 14 located in for example, Tokyo. Presently, the cheapest long distance rates in the world are for calls placed through the United States. Therefore this may be the most cost effective solution for the call-back service to route the call via a POP 14 located in New York city.

It is further contemplated that other types of input means (SFMs 28) are useful as a means of establishing a communication connection with system 10. For example, in one situation, where a subscriber does not personally possess a facsimile machine, it is contemplated that the subscriber could physically bring, mail or deliver the facsimile to a sending location such as a retail type kiosk or similar arrangement. The kiosk would be set-up to electronically convey the facsimile to system 10. Such electronic conveyance could include a scanning means whereby the facsimile is electronically scanned into a computing means and then converted into a text digital format by a conversion technique such as Optical Character Recognition (OCR). Such

scanning and OCR techniques are well known in the art and will not be described in any detail. In another form, the kiosk could simply include an SFM 28 device, wherein the present example, SFM 28 is remote relative to a user and wherein the user has to physically send the facsimile to the kiosk to access system 10. It is further contemplated that such an arrangement could be useful in less commercialized countries or in countries where SFM and/or DFM devices are not common place. Furthermore, the kiosk establishment could be licensed as franchises wherein the franchisee is the subscriber and the long distance facsimile service is sold to the general public without the requirement for the user (or company) to personally subscribe to system 10.

An alternative arrangement of this situation would be to further provide a facsimile receiving service via an RFM 34 located at the kiosk arrangement. In this case, the user could provide the kiosk RFM 34 facsimile number to subscribers wishing to send long distance facsimiles to the user. The user would then retrieve the facsimile at a later time subject to a fee.

Other means of conveying the facsimile to system 10 would include replacing SFM 28 with an electronic forwarding means such as an e-mail or internet type arrangement. In this situation, the subscriber e-mails or electronically forwards the facsimile to the system. One advantage to this type of arrangement is that the documents are in a digital format prior to transmission to a predetermined FPOP 14. The advantage is that while conventional PSTN facsimile transmissions are analog and publicly accessible and therefore unsecure, a digital transmission can be encrypted for security. As a subscriber, system 10 could provide encryption software, as an add-in to the subscribers e-mail software, and an encoding key. Once the digital transmission is received by FPOP 14, the facsimile transmission is decrypted with a decryption key

corresponding to the encryption key provided to the subscriber. Each subscriber has a unique encryption key analogous to a Personal Identification Number (PIN) employed with respect to banking cards.

In further situations it may be advantageous to install FPOP 14 "locally" to a subscriber group as may be the case with large institutions such as banks, law firms or large corporations where thousands of facsimile pages are transmitted from one location each business day. In this case, communication lines 30 connecting to FPOP 14 may be facilitated via a private branch exchange (PBX) system or simply internal phone lines. FPOP 14 may be further connected with a facsimile server where facsimiles are sent from personal computers operating over a local area network (LAN). Locating FPOP 14 within a business institution as an locally connected component to a PBX system or LAN facsimile server system provides the additional advantage of increased facsimile security. This is due to the fact that the facsimiles are received by system 10 without being communicated via conventional PSTN which are not secure lines and are publicly accessible. However, system 10 provides encryption security for the subscriber throughout the routing from FPOP 14 to DPOP 14. The method of encrypting facsimile transmissions will be described in greater detail below. Furthermore, if POP 14 is located within a business institution, the POP further acts as a local DPOP for incoming facsimile transmissions prior to routing internally via the facsimile server or local department or central services RFMs 34. Once again, as the final transmission between DPOP 14 and RFM 34 is internal to the business organization, facsimile security is enhanced.

POP CONFIGURATION

Figure 2 illustrates the hardware components associated with one POP 14 (FPOP, IPOP, DPOP) which forms a component of system 10. As indicated in the Figure, POP 14 generally comprises, a pair of processing means 104,104', a pair of terminals 108,108', a pair of communication means 112, 112' and a pair of modem banks 116,116'. As is apparent from the Figure, POP 14 is designed as a fully redundant system wherein if one component fails, the corresponding redundant component takes over. Preferably the hardware components which comprise POP 14 are "hot-swappable" meaning that redundant components take over on-the-fly without the requirement of rebooting the entire POP. As is the case with most processing systems, the weakest link is typically the power source. Typically, this is due to the fact that only one independent power source is available. As would be apparent to those of skill in the art, a conventional back-up power unit (not shown) can be included as a component of POP 14 to alleviate a processing failure due to a power interruption. While the hardware configuration shown depicts a fully redundant system, it may not always be necessary to provide such fully redundant components. Furthermore, POP 14 would still be operational if all or some of the redundant components are eliminated from the design.

Processing means 104,104' can be any suitable computer however, the present inventors have determined that a computing means employing a UNIX operating system such as a Digital Equipment Corporation (DEC) Alpha™ mini computer or a Sun Microsystems Corporation SPARC™ computer is preferable. As would be apparent to those of skill in the art, monitors 108,108' can be any suitable display means which are connectable and compatible to processing means 104, 104'.

With respect to the communication aspect of POP 14,

communication means 112,112' preferably comprise any suitable router such as Model # 2501 as manufactured by Cisco Systems. Communication means 112,112' are employed for transmission of digital data comprising the facsimile and related data to subsequent IPOPs 14 and DPOP 14 via VPN 18. Typically, routers are employed when communicating with a packet-transfer network. Furthermore, communication between POP 14 and RADB 22 is accomplished via routers 112, 112' and a dedicated connection.

Preferably, communication means 112,112' would be configured to support a wide selection of communication modes available for communication with VPN 18. In effect, the more communication modes supported by communication means 112,112', RADB 22 will have more options available when optimizing the facsimile routing for the most cost effective routing and/or most timely routing available. For example, the type of communication route available could include, conventional PSTN, dedicated PSTN lines, ISDN lines, dedicated T1 or T3 lines, satellite communication, etc.

Modem banks 116,116' each comprise a plurality of modems and is sized to accommodate the number of PSTN communication lines 30,38 (telephone lines) required by POP 14. The present preferred arrangement is for modem banks 116,116' are modem cards such as those manufactured by Brook trout, model number TR114. The present inventors have determined that an average size POP 14 would require the attachment of approximately 100 communication lines 30,38. This number of lines is a sufficient number of communication paths for SFMs 26 and RFMs 34 to substantially eliminate the chances of a subscriber experiencing busy signals or system delays. However, traffic requirements depend on population, success or popularity of the service and geographic location. Therefore, the sizing of communication lines 30,38

should be determined based on the load requirements experienced by each POP 14 individually.

It is further contemplated that while initially, the configuration of Figure 2 is suitable for POP 14 hardware structure is useful for the initial construction and deployment of system 10, the described structure is capital intensive. Therefore, as it is reasonable to assume that deployment of system 10 on a global scale could easily require 100,000+ POP 14 installations, POP 14 could be custom designed as a single integrated unit built to endure rigorous environmental conditions. It is further contemplated that a distributed (leaf) POP 14 structure could be employed to cover a wider customer area. For example, modem banks 116,116' could be located remote of the processing means 104,104' and communicate via a dedicated connection. This situation may be viable where the closest POP 14 to a subscriber base is located in a different area code requiring the subscriber base to place long distance calls to access POP 14. In this case, modem banks 116,116' could be located within the subscriber base area code to eliminate the requirement of placing a long distance call in order to access system 10.

ROUTING/AUTHORIZATION DATABASE

RADB 22 is a processing means which provides all of the routing and authorization of facsimile traffic operating across system 10. In the present embodiment one RADB 22 is provided which communicates with each of the plurality of POPs 14 on the system. However, it is contemplated that in through expansion of system 10 to a worldwide facsimile network, a network of RADBs 22 may be established to handle the increased routing and scheduling requirements. In this situation, a discreet number of POPs 14 will communicate

directly to one preassigned RADB 22. It is further contemplated that given the present configuration of system 10 shown in Figure 1, RADB 22 may be configured as a fully redundant system similar to that described with respect to POP 14 in order to prevent total system failure in the event of a malfunction. The method of scheduling and arbitrating facsimiles will be described in greater detail below.

An alternative arrangement of RADB 22 would be to separate the traffic handling requirements to a communication hub and to reserve the function of RADB 22 to that of routing and scheduling.

BILLING AND FINANCIAL DATABASE

Billing and financial database 24 is a processing means which largely handles the business management aspects of system 10. For example, facsimile routing policy objects, routing rate information, service policy objects, customer billing, subscriber contracts, and administrative POP 14 management functions are managed by BFDB 24. As an example of the functionality of BFDB, Appendix A illustrates a plurality of data entities and the relationship therebetween, which may be included in BFDB 24. As should be apparent to those of skill in the art, the present invention is in no way limited to the data entities depicted in Appendix A as entities may be added or removed depending on the management structure and availability of resources of system 10. Appendix B is a glossary describing the functionality of each of the data entities described graphically in Appendix A.

SIGNALING MEANS

One requirement of the subscriber using system 10 is that each facsimile transmitted be accompanied by a signaling means. The signaling means indicates to system 10 a plurality of information for use by the system, including but not limited to, data such as: the facsimile number of DFM 34; transmission options; authorization code; and administrative information such as subscriber identification number, predefined destination list and/or predefined facsimile documents.

With respect to the presently preferred embodiment of the present invention, the signaling means is in the form of a key page 200, as illustrated in Figures 3a or in an alternative in Figure 3b. In use, key page 200 is attached to the facsimile as a leading page, placed ahead of a conventional cover page. As indicated in the figure, keypage 200 comprises a plurality of data boxes in which, the subscriber is to enter a plurality of data, as indicated above. Specifically, keypage 200 includes: a dialing digits data box 204; an authorization code data box 208; a time constraints data box 212; and, optionally, a known destination list data box; and a known documents data box (not shown). Further included on keypage 200 is at least one registration means 202 arranged in a predetermined manner proximal the top and bottom edges of keypage 200. The at least one registration means 202 is preferably in the form of a graphical icon which, in the case of Figure 3, is depicted as a small square. Registration means 202 is employed to alert system 10 that a facsimile is about to be received and to indicate the orientation of the keypage in SFM 28. Orientation of keypage 200 is a significant concern as system 10 requires some means to indicate how the data is to be read by FPOP 14. For example, should the subscriber insert keypage 200 into SFM 28 upside down, FPOP 14 needs to be informed that the keypage data contained in the plurality of data boxes is to be read in upside down and backwards and then converted for interpretation.

Key page 200 further includes a subscriber identifier means 210 which, as shown in Figures 3a and 3b is a bar code. Subscriber identifier means 210 is employed to identify data to system 10 representing the validity of the subscriber employing key page 200. For example, keypage 200 may include data representing a time expiry limit on the keypage. If system 10 detects that keypage 200 has expired, the facsimile will not be authorized for transmission. As a security feature, data contained in subscriber identifier 210 is compared with authorization code 208 to determine the validity of the subscriber attempting to employ system 10.

As indicated in the Figure 3, the plurality of data boxes are fashioned to resemble a grid and are sized to permit entry of the required length of data per data item. For example, preferably, dialing digits data box 204, which contains data representing the destination facsimile number, is sized to accommodate a maximum of a 24 digit number which enables the subscriber to accommodate any long distance number including country code, area code and actual destination number. Therefore, as indicated by the Figure 3, dialing digits data box 204 would be formatted as a grid 24 columns wide by 14 rows in height. As would be apparent to those of skill in the art, the 10 row height is sized to accommodate the digits from 0 through 9 plus the # and * characters, a 'pause' character, and a 'cancel' character.

Similarly, if the authorization code is numeric, the authorization code data box 208 is similarly sized ten rows in height but the number of columns in width will be variable depending on the appropriate length of a suitable authorization code.

Time constraints data box 212 is provided for the subscriber to

indicate to system 10 the time urgency consideration of the facsimile being sent. It is contemplated that a simple scale from 1 to 5 may be used in which the data box would appear as a 5 column single row matrix. The subscriber would mark 5 for extremely urgent or progressively scale their way down to 1 which would indicate to system 10 that the facsimile is not urgent and is available, for example, a two-day delivery time. Time constraints data box 212 is significant in the sense that typically, the fees a subscriber will pay for transmitting their facsimile via system 10 would be scaled in accordance with the desired time urgency. Furthermore, a specification of time constraint permits system 10 to move away from real-time facsimile transmission which would inevitably alleviate critical scheduling considerations during peak operating times. The method of scheduling and co-ordinating traffic over system 10 will be described in greater detail below.

The advantage of employing keypage 200 of Figure 3a is that the subscriber simply enters the data required by system 10 by means of shading in boxes corresponding to the correct alpha-numeric data. This method is analogous to bubble card technology developed by IBM however, it provides a means of conveying data to system 10 which is both easily readable by the subscriber and accurately readable by system 10. The bubble card format provides the advantage that the user may quickly and easily fill out the required information on the key page without any special knowledge of data formats as previously required by several prior-art methods such as bar-coding techniques.

An alternative embodiment of keypage 200 is indicated in Figure 3b. In this case, dialing digits data box 204 is designed to resemble a conventional numeric dialing pad of a telephone. This could be included as an optional feature to appeal to customers who are not comfortable with the use of

conventional bubble type data entry. To enter dialing data into the configuration of Figure 3b, the subscriber simple strokes a marking instrument through the white rectangle proximal the desired digit. If the subscriber makes an entry error, the subscriber simply strokes the marking instrument through the entire column as indicated in the figure.

It is further contemplated that the key page could be put into a digital document form which may be filled out on a conventional word processor program or incorporated into facsimile software in a similar manner to that of conventional predefined cover page libraries and/or address databases. For example, the popular Delrina Winfax™ software program could include an addition whereby, upon selecting the recipient of the facsimile from the integrated phone book feature, the software would then automatically generate the appropriate key page which would be placed ahead of the cover page in the facsimile. The standard subscriber data as that previously described with respect to items 204 through 220, would be transposed onto the key page automatically prior to each transmission, from data input once from either a set-up window or on configuration options similar to those already employed with respect to set up of station ID.

Alternatively, when employing a software package such as facsimile software, a physical representation of keypage 200 is not required to be generated. A dialog box would be employed to permit the subscriber to enter the keypage data which is either converted automatically to a DTMF signal or is transmitted ahead of the facsimile as a T.29 binary object in a data packet.

While keypage 200 is preferred as a means of signaling system 10 as to an incoming facsimile transmission, there are several alternative signaling means which may be employed with equal success. Specifically, in one

instance, touch-tone signaling may be employed using the conventional Dual Tone Multi-Frequency (DTMF) and T.30/T.130 standard. In this instance, it is contemplated that a subscriber could physically enter the keypage data by inputting the required data via a telephone keypad analogous to conventional phone-mail type signaling.

Another type of signaling means which could be employed with equal success is that of digital identification which provides a second level of security. Digital identification, such as Direct Inward Dialing (DID) wherein the subscriber group is assigned a block of dial-in numbers which are in turn, assigned to individual members in the group. Therefore, each member in the subscriber group has their own unique number with which they dial FPOP 14. When combined with each subscriber's authorization code, a second level of security is provided against unauthorized use of the system. For example, if an unauthorized person obtains keypage 200 which has been previously completed to include the authorization code by a subscriber, it is possible use the subscriber's authorization code and duplicate keypage 200. In this event, unauthorized use of the system is possible resulting in a subscriber being billed for facsimiles they didn't send. However by employing the DID scheme, the unauthorized user would have to call FPOP 14 by dialing the assigned DID number or system 10 would not accept the facsimile.

Other types of signaling means could include: handwritten signaling wherein a subscriber handwrites the data and POP 14 is provided with software for identifying and converting handwritten text to digital data; typed keypage signaling wherein a subscriber types via a typewriter or word processing the data required on keypage 200, then POP 14 employs OCR or optical character recognition to convert the keypage data into digital data; and

verbal signaling wherein a subscriber tells POP 14 the required information and wherein voice recognition software is employed to convert to digital format.

More sophisticated signaling means could include digital media wherein a subscriber completes a keypage on-line via a personal type computer upon establishing a modem connection with POP 14. Alternatively, an interactive signaling means could be employed such as the completion of an internet web page or an e-mail form which is then transmitted to POP 14 upon completion of the keypage. Facsimile pages could then be transmitted as an attachment to the keypage in digital format.

As previously indicated, each POP 14 is responsible for receiving the facsimile sent by the subscriber using SFM 28 and transmitting the facsimile to DFM 34. As shown in Figure 2, the function of each POP 14 is not limited to the tasks of receiving and transmitting facsimiles.

The process of sending long distance facsimile in accordance with the presently described embodiment of the present invention is illustrated in Figures 4 and 5. As indicated in Figure 4, the process for sending long distance facsimile with respect to the subscribers are indicated generally at 300. This process assumes, however, that the user has subscribed to the service and has entered into a contract arrangement with the providers of system 10. It is contemplated that in subscribing to a system 10, the subscriber has a plurality of options available to them including selecting their appropriate custom billing and customize keypage options which will depend on the nature of the organization. The details of these options will be described in greater detail below.

The functional responsibility of RADB 22 and BFDB 24 in relation to dataflow through system 10 is illustrated in Figure 4. As shown in figure, RADB 22 generally governs routing of all facsimile transmissions between FPOP 14 and/or DPOP 14. When any one of the plurality of POPs 14 functions as a FPOP, two-way routing and authorization communication is established between RADB 22 as indicated by the double-headed arrow between FPOP 14 and the routing function. The routing function of RADB 22 is optimized for speed and as shown in the figure, the routing between an FPOP, IPOP and DPOP is determined by this routing function. Furthermore, the routing function of RADB 22 receives routing policy instructions from BFDB 24. The routing policy function of a BFDB 24 is optimized for analysis and is governed by a set of rules based on available resources, available routing, time of day and cost considerations. Therefore, the routing optimization of RADB 22 is governed by the routing policies BFDB 24. When the routing policy changes, the routing function of RADB 22 is adjusted accordingly. RADB 22 further forwards database records generated for each facsimile transmission based on the subscriber identification and authorization and call details to a call details records component of BFDB 24. These records are, in turn, in communication with a billing/service policy object. The billing/service policy object of BFDB 24 is a policy object which identifies a basic rule structure to govern billing procedures and/or custom billing options if requested by the subscriber, subscriber authorization codes and customized subscriber security features. A feedback mechanism is also included as a service component of BFDB 24 and provides feedback to the service policy component. This enables the feedback to adjust the service policy to better identify the needs of the customers and/or subscribers. While it is contemplated that the routing policy object would be governed by an expert system, the billing/service policy object could, in fact, be a manual method but is nonetheless provided as an interface for adjusting the

service policy of system 10 for enhanced performance.

PROCESS

The process of transmitting a long distance facsimile from a subscriber to a destination by means of employing system 10 is described with respect to Figure 5 and indicated generally at 300. The first step in transmitting a facsimile via system 10 is for the subscriber to prepare keypage 200 by completing the required data fields as previously described (block 304). The subscriber then places keypage 200 as a first page of the facsimile and inserts the document into SFM 28 (block 308). At block 312, the subscriber then dials system 10 via an assigned FPOP 14. The assignment of FPOP 14 to a particular subscriber is dependent on a number of factors. These factors include geographical relationship and/or telephone long distance cost considerations as previously described. Furthermore, in some instances, when the subscriber wishes to use system 10 but is not in a location proximal to the assigned FPOP 14, it is contemplated that the subscriber would be able to call into a information line which will provide them with the facsimile number of the closest FPOP 14.

At block 316, FPOP 14 answers the incoming subscriber call and receives the facsimile into the system. As would be apparent to one of skill in the art, as the facsimile is received into FPOP 14, it is converted from the conventional analog facsimile protocol employed into a digital data stream. As FPOP 14 identifies keypage 200 as the first page of the facsimile by identifying registration means 202 (block 317). If a keypage is not identified, FPOP 14 terminates the transmission and/or sends an error report back to subscriber SFM 26 if the subscriber facsimile number can be determined from the telephonic connection (block 318). If the keypage was identified, the process moves to

block 320 where FPOP 14 separates keypage 200 from the facsimile. As would be apparent to one of skill in the art, an identification means is used to identify the separated keypage 200 with the corresponding facsimile. At block 324, FPOP 14 assembles data from keypage 200 into a keypage packet. The contents of the keypage packet and relationship to system 10 will be described in greater detail below. As indicated at block 328, the FPOP 14 then moves the package to a queue in preparation for transmission to RADB 22. At a predetermined interval, the keypage packets are then transmitted to RADB 22 for authorization (block 332).

RADB 22 then receives the keypage packet. If the authorization is accepted (block 340) RADB 22 proceeds to prepare the routing for the facsimile (block 344). At a predetermined time interval, the routing information is transmitted with the authorization back to FPOP 14 (348). If, at block 340, authorization is rejected, the process moves to block 352 where a no authorization message is transmitted back to FPOP 14. The bitmap image of keypage 200 is then stored to memory at block 356 and a copy of the image is sent to a queue for transmission to RADB 22 (block 357). On a predetermined time interval, the bitmap images in the queue are transmitted to RADB 22 and then to BFDB 24 for archival and auditing purposes (blocks 359 and 359a).

Once the authorization message is returned to FPOP 14 (block 358) from the process of blocks 348 and 352, FPOP 14 sends a status message confirming or rejecting the subscriber transmission (block 360) via a facsimile to DFM 34 (previously SFM 28). FPOP 14 then compresses, encrypts and stores the facsimiles (blocks 364, 368, 372) in preparation for transmission to DFM 34. Depending on the time urgency constraints indicated in time constraints data block 212 of keypage 200, the compresed and encrypted

facsimile is entered into the transmission queue at a scheduled time (block 374). In preparation for transmission, the facsimile is then packetized at block 378 and then transmitted via the routing determined from RADB 22 via VPN 18 (block 382). The communication mode employed by VPN 18 is determined by the routing optimization performed by RADB 22 at block 344. These instructions are attached in the packetized facsimile transmission for routing purposes. At block 386, the packetized facsimile transmission is now received at either IPOP 14 or DPOP 14. If the transmitted facsimile has arrived at DPOP 14 (block 390), the facsimile waits for clearance to transmit to DFM 34 (block 392). Once clearance is received, the facsimile is then decrypted (block 394), decompressed (block 398) and finally transmitted from DPOP 14 to DFM 34 (block 402).

DPOP 14 then confirms completion of the facsimile transmission to BFDB 24 (block 404) and also notifies FPOP 14 at block 408. FPOP 14 then sends confirmation of the success or failure of the facsimile transmission to the subscriber via DFM 34 (previously SFM 28) (block 412). At this point, the facsimile transmission is complete and the process ends at block 416.

If at block 386, the facsimile arrives at an IPOP 14, the decision at block 390 causes the facsimile transmission to continue on the routing determined by RADB 22 (block 420) via VPN 18 and the process moves back to block 386 until DPOP 14 is encountered.

As indicated at block 356, FPOP 14 keypage 200 is retained and stored to fixed storage as a bitmap image. The purpose for converting the keypage into a bitmap image is two-fold. Firstly, the bitmap image of the keypage can be used for auditing purposes for verification against what the subscriber has sent through system 10. Secondly, the bitmap images can be used

for internal diagnostics to check to determine whether FPOP 14 is forwarding or delivering the facsimiles as per the instructions of RADB 22.

As previously indicated in the discussion with respect to the process depicted in Figure a, the events occurring at block 328 and 357 are situations in which the packeted data is queued prior to being transmitted to RADB 22. The primary reason for queuing is due to the fact that when considering the deployment on a worldwide scale, several hundred thousand transactions may be occurring at any one time. Furthermore, the system 10 is constructed with a centralized architecture, only one RADB 22 unit and one BFDB 24 unit services the plurality of POPs 14. The present inventors have determined that a preferred method of communication involves the polling technique. Therefore, RADB 22 polls each of the plurality of POPs 14 at predetermined time intervals. When a particular POP 14 is polled, the connection time between POP 14 and RADB 22 occurs for a discrete time interval.

The present inventors have termed this regulated polling to be a "heartbeat". It is anticipated that a typical heartbeat would occur every four minutes. When RADB 22 sends out a heartbeat to a specific POP address, FPOP 14 responds with a send request. Upon acknowledgment of the send request, FPOP 14 transmits the keypage packets queued at block 328 in Figure a. RADB 22 then processes these keypages to determine authorization and routing as per blocks 336 through 352. Depending on the system resources available and the traffic on the network, there may not be enough time for RADB 22 to process all the keypage requests and return with authorizations and routings. Therefore, FPOP 14 would have to wait until a subsequent heartbeat to receive the authorizations and routings. During the time interval in which

FPOP 14 is in communication with RADB 22, and while waiting for return authorizations and routings, FPOP 14 may further transmit keypage 200 bitmap images queued at block 358 of Figure a. This time interval may also be used for transmission of diagnostic data for determining system integrity.

It is envisioned that there are five possible transmission modes which may be implied for successful data transmission between RADB 22 and FPOP 14. The use of each mode will be determined by the size of the network, as determined mainly by the number of FPOPs 14 in communication with RADB 22 or the volume of data traffic transmitted across system 10.

The first mode of communication is a real-time mode in which FPOP 14 uses an interrupt signal to RADB 22. In this case, upon the interrupt signal, RADB 22 responds by opening a communication line at the request of the FPOP. While this situation is useful for smaller networks, each of the plurality of FPOPs 14 controls the communication to RADB 22.

The second data transmission mode is one in which authorization and routing occur upon the heartbeat sent out by RADB 22. This mode implies that FPOP 14 sends the keypage packets and receives authorization and routing instructions prior to the discrete time interval timing out. This is a preferable mode of operation as each plurality of FPOPs 14 are not required to wait over successful heartbeats.

Using a third mode of communication, upon a first beat, keypage packets are transmitted to RADB 22 and authorization is returned, however, there might not be enough time to complete the routing instructions before the discrete time interval times out. Therefore, the completion of the routing

instructions will be returned upon a second beat communication with the FPOP.

The fourth mode of communication is one in which authorization is transmitted from RADB 22 to FPOP 14 upon a first beat from RADB 22 and routing instructions are returned upon a second beat.

A fifth mode of communication is one in which the keypage packets are transmitted to FPOP 14 from RADB 22 with diagnostics and optional bitmap image transmissions and authorization routing is returned upon a second beat initiated by RADB 22. It is contemplated that this mode of communication would be useful for a significant percentage of the time due to the processing requirement placed upon RADB 22 when communicating with a large network of POPs 14.

The sixth mode of communication is one in which POP 14 will have to wait for a third or subsequent heartbeat from RADB 22 before authorization be returned.

As previously described with respect to Figures 5a through 5c, upon separation of keypage 200 from the facsimile at block 320, POP 14 assemblies a keypage packet. Preferably, the keypage packet only includes the required data extracted and interpreted from the data boxes contained on keypage 200. By employing this approach, the packet size can be reduced to alleviate the extra data required to reproduce keypage 200 in its complete form. Furthermore, keypage 200 is converted to a bitmap image in its entirely at block 356 for auditing purposes. These bitmap images can be transmitted out of real-time at the convenience of a RADB 22 and FPOP 14 depending on the volume of data traffic, thereby reducing or alleviating processing demands on a RADB

22 during peak traffic periods.

Typically, the keypage packet will include the following data items: POP identification; time stamp; a send request; time priority; user identification; document identification; destination identification; and a content description. More or less data items may be included depending on the nature of the facsimile transmission. However, it is preferred that all the data required for RADB 22 to process a given authorization and routing be included in one packet for processing processes. It is also preferred that the keypage packet be transmitted at the highest priority level between FPOP 14 and RADB 22 relative to diagnostic data transmission and bitmap image transmissions.

RADB 22 returns authorization for a particular facsimile transmission with data representing one of four possible states. Specifically, a clear signal indicates that POP 14 is permitted to transmit the identified facsimile along the forthcoming routing path. A not clear signal indicates that a particular facsimile transmission is not authorized for routing, thereby instructing that FPOP 14 to hold the facsimile. A third unknown state can occur when RADB 22 had not sufficient time to complete the authorization request, thereby instructing POP 14 to wait for further instructions. Finally, the fourth authorization state occurs when RADB 22 returns the data instruction indicating FPOP 14 to use discretion in transmitting the identified facsimile. In this situation, POP 14 is required to make its own decision as to authorizing the routing and transmission of the facsimile. This situation can occur when operating in a default mode where routing is determined by employing a destination DPOP 14 routing lookup table.

As previously stated with respect to Figure 5, the facsimile is

finally transmitted from DPOP 14 to DFM 34 at block 402. During this step, several events can occur when attempting a facsimile transmission to DFM 34. If DPOP 14 is successful in its transmission to DFM 34, the facsimile file transmitted is deleted from the memory of DPOP 14. If a problem in the transmission occurs, DPOP 14 can attempt a fixed number of retrys thereby successively attempting a successful transmission. However, there may be situations in which no fax signal is detected, DPOP 14 encounters multiple rings, or a non-fax line is detected. Under these events, a retry attempt can be made thereby attempting successful transmission. The decision with respect to the number of successive retrys is particularly dependent on the location of the DPOP and any local rules or regulations governing retry attempts. For example, some country rulings may limit the number of retry attempt as, in the event that a non-fax line is detected, the owner of the non-fax line could encounter many annoying retry attempts. This would inevitably lead to complaints and generate a negative public reaction. Therefore, it is contemplated that each DPOP 14 would be programmed with a basic instruction set which is customized to the local governing rules and regulations regarding telecommunications.

In the event of a failure for DPOP 14 to successfully transmit the facsimile to DFM 34, the confirmation to FPOP 14 and RADB 22 will be a failure status signal. Upon notification of a failure by POP 14, a notification to the subscriber would be transmitted at block 412. The failure status report could include customer options or an indication as to the nature of the failure, for example, an indication of a busy signal or a non-fax line encountered.

System 10 further includes an error detection means in the event that one of a number of possible failures to components connected to the system. In the event of a heartbeat failure from RADB 22, the plurality of POPs 14

could switch to a default mode wherein routing will automatically defaults to an outbound service via VPN 18. Typically, a heartbeat failure would indicate that RADB 22 has gone off-line which could potentially indicate a catastrophic failure of system 10. Therefore, a second possible solution to prevent this type of failure would include a second fully redundant RADB 22 system analogous to that described with respect to POP 14. The benefits of maintaining a fully redundant systems configuration is that the second machine can act as an active boot server which may be used to diagnose and reboot the failed component automatically. Furthermore, this would ensure that the system 10 would only fail if both machines went down simultaneously or in turn. It is preferred that the system 10 be configured such that in the event of failure, the system can be backed by online automatically with no human intervention.

It is further contemplated that system 10 includes diagnostic and remote servicing systems to enable maintenance of the plurality of POPs 14 from remote locations. For example, preferably system 10 is configured such that any one of the plurality of POPs can be rebooted automatically remotely from a remote location. Furthermore, diagnostic systems are preferably in operation which would verify the status of the equipment at any given time and verify the status of the software. It is also preferred that software changes, fixes and/or updates can be made from a remote console and, in the event, that any one of the redundant systems fails to go online upon failure of its counterpart, remote systems would permit the initialization of equipment remotely.

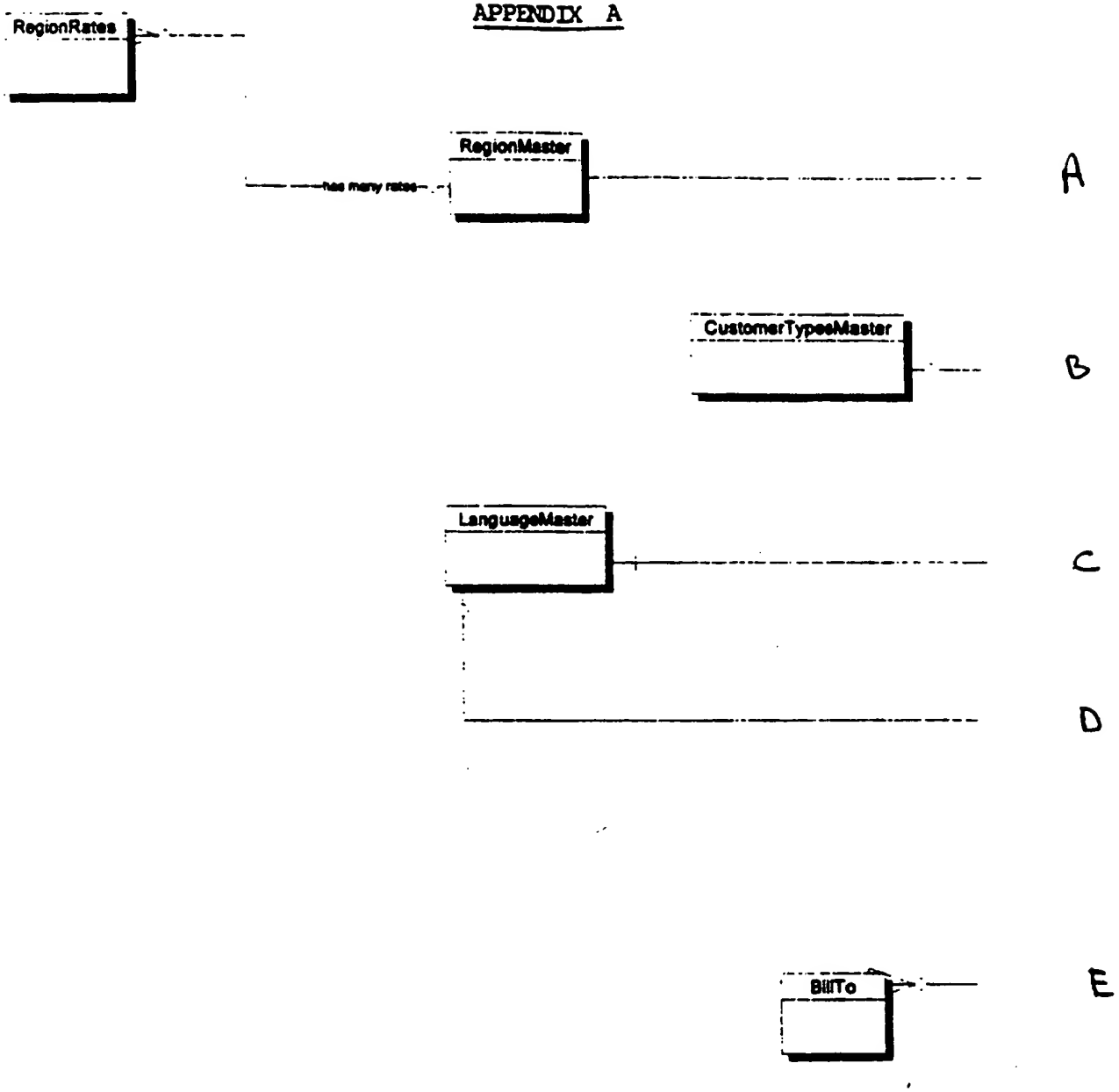
The facsimile transmission network of the present invention employs both in-band and out-of-band signaling methods. Specifically, in-band signaling is used with respect to facsimile protocol between SFM 28 to FPOP 14 and between DPOP 14 and RFM 34. Out-of-band communication is used

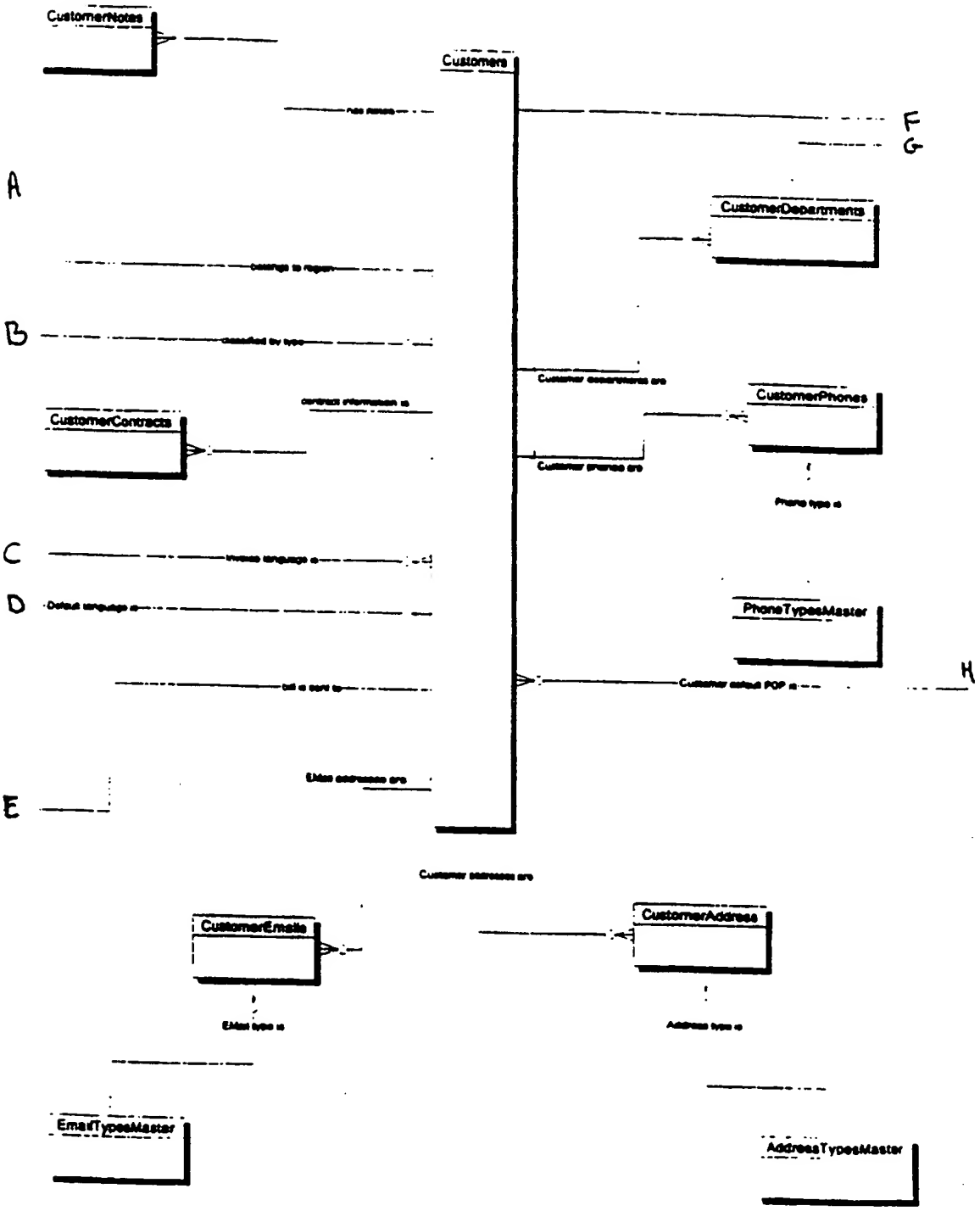
within the network, therefore permitting the system to operate out of real-time depending on the time constraints associated with a particular facsimile passing through system 10. The out-of-band signaling and associated time constraints of each facsimile permit scheduling and routing of facsimiles which is flexible to the demands placed on the processing power of system 10 at any given time.

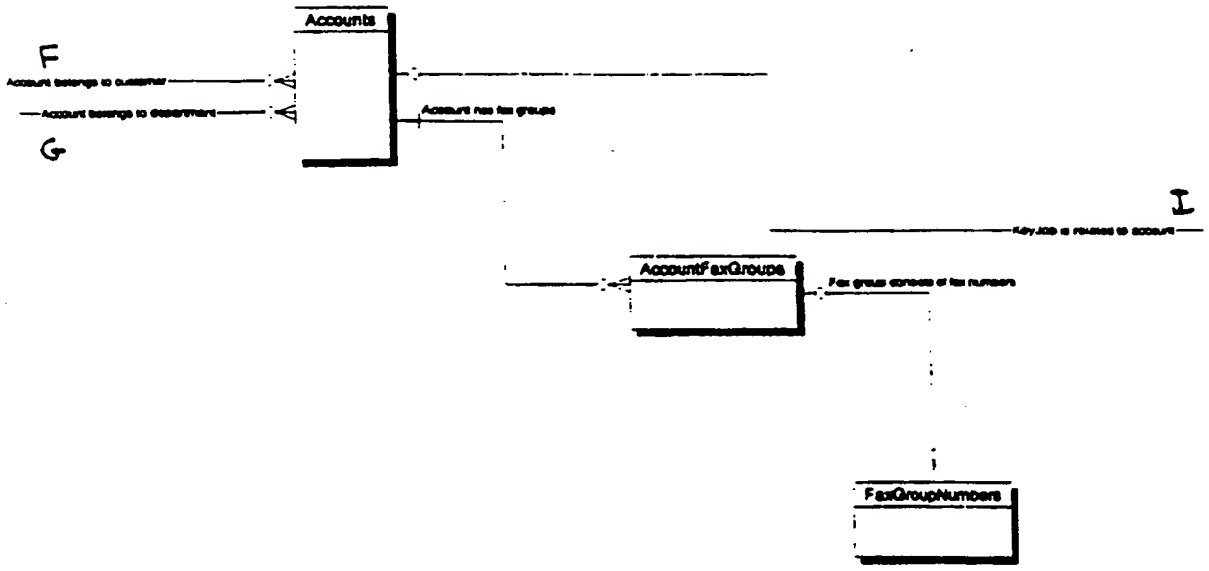
Furthermore, the facsimile transmission system of the present invention operates as a centralized system wherein RADB 22 and BFDB 24 are located at the heart of the system and control the operation of the plurality of POPs 14 attached thereto. Once again, this type of system is preferable in that a large number of POPs can be connected while maintaining scheduling integrity.

The present invention has been described with reference to a presently preferred embodiment. Other variations and embodiments of the present invention may be apparent to those of ordinary skill in the art. Accordingly, the scope of protection sought for the present invention is only limited as set out in the attached claims.

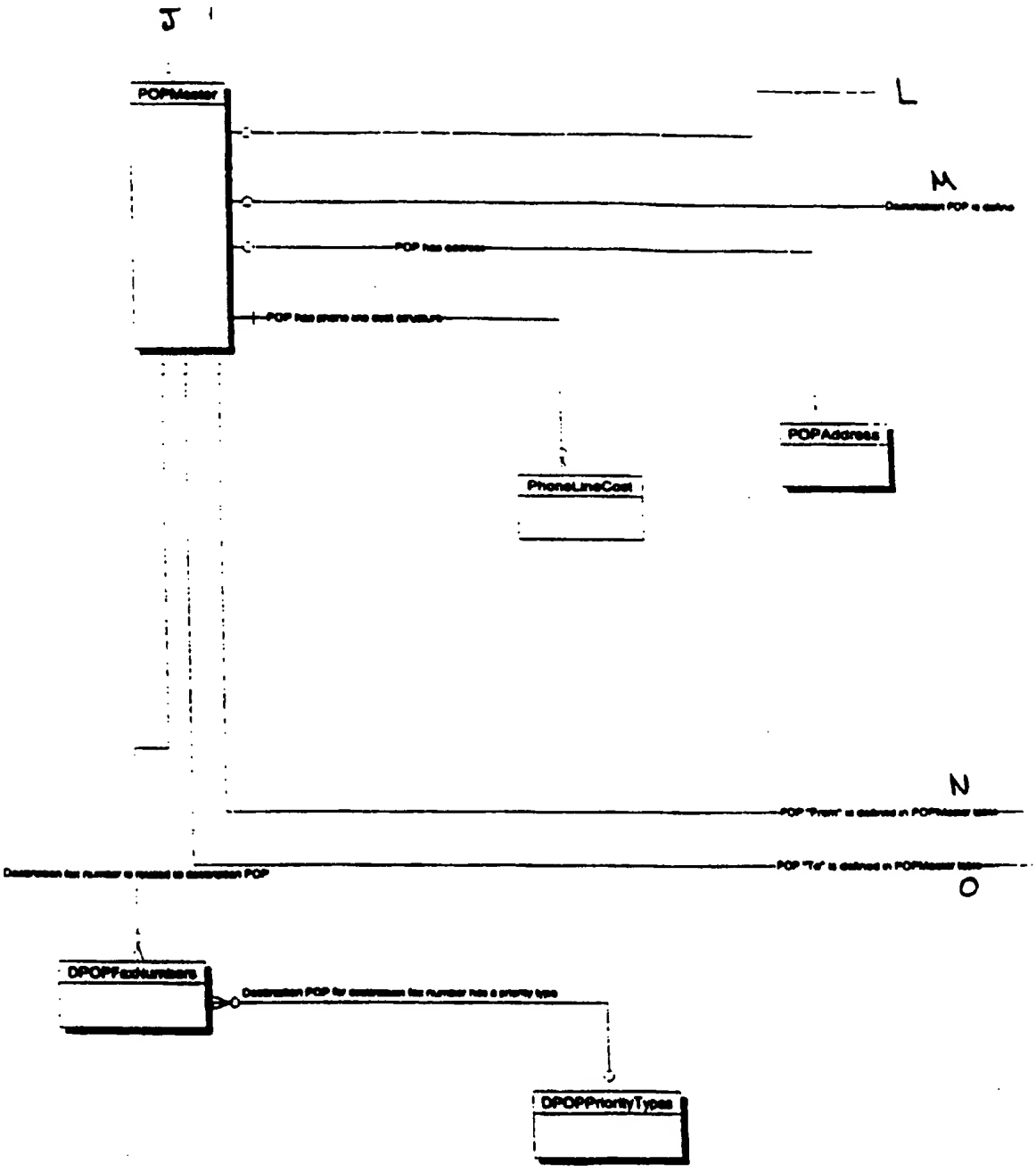
APPENDIX A

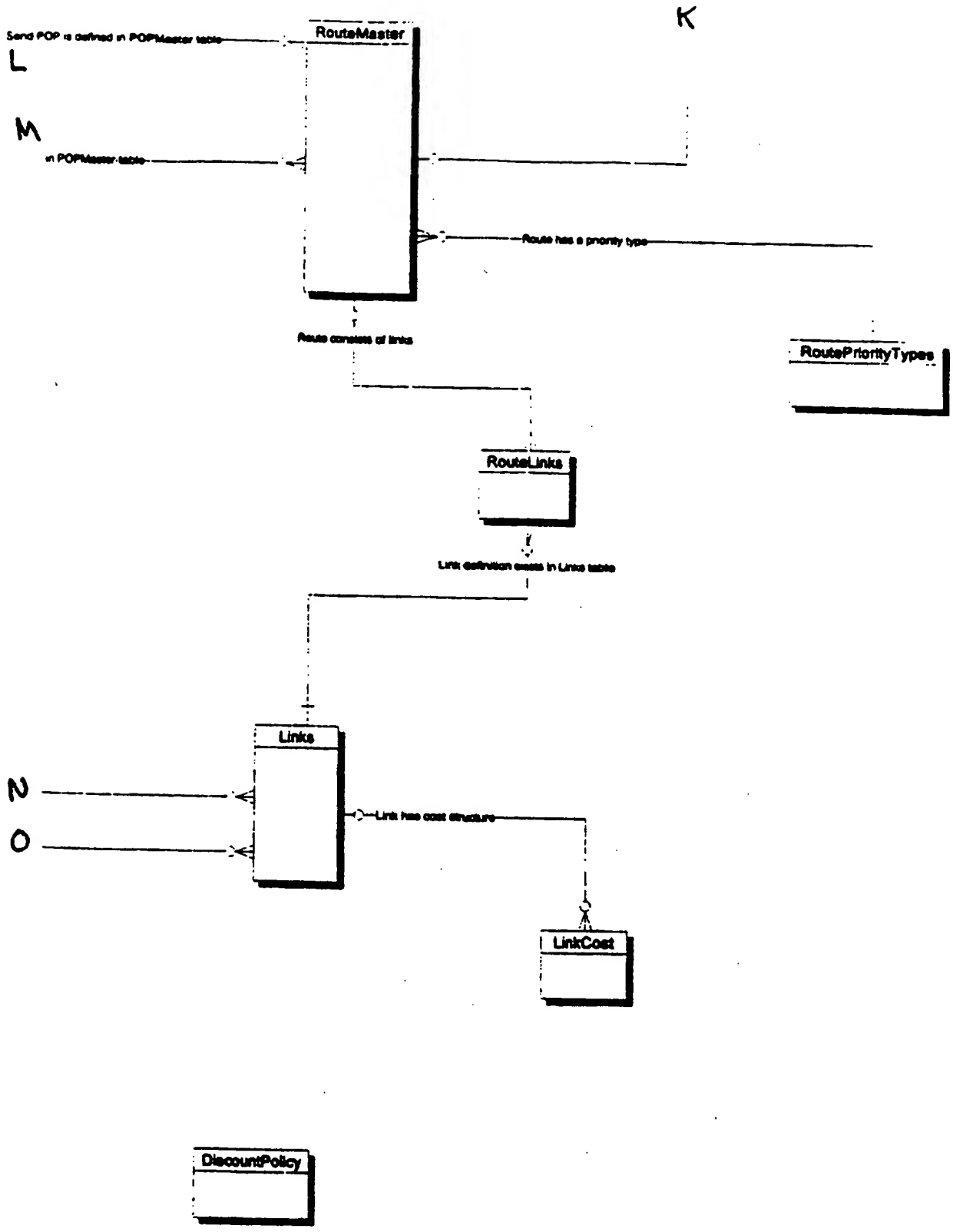

RegionRates
RegionMaster
has many rates
A
CustomerTypesMaster
B
LanguageMaster
C
D
BillTo
E

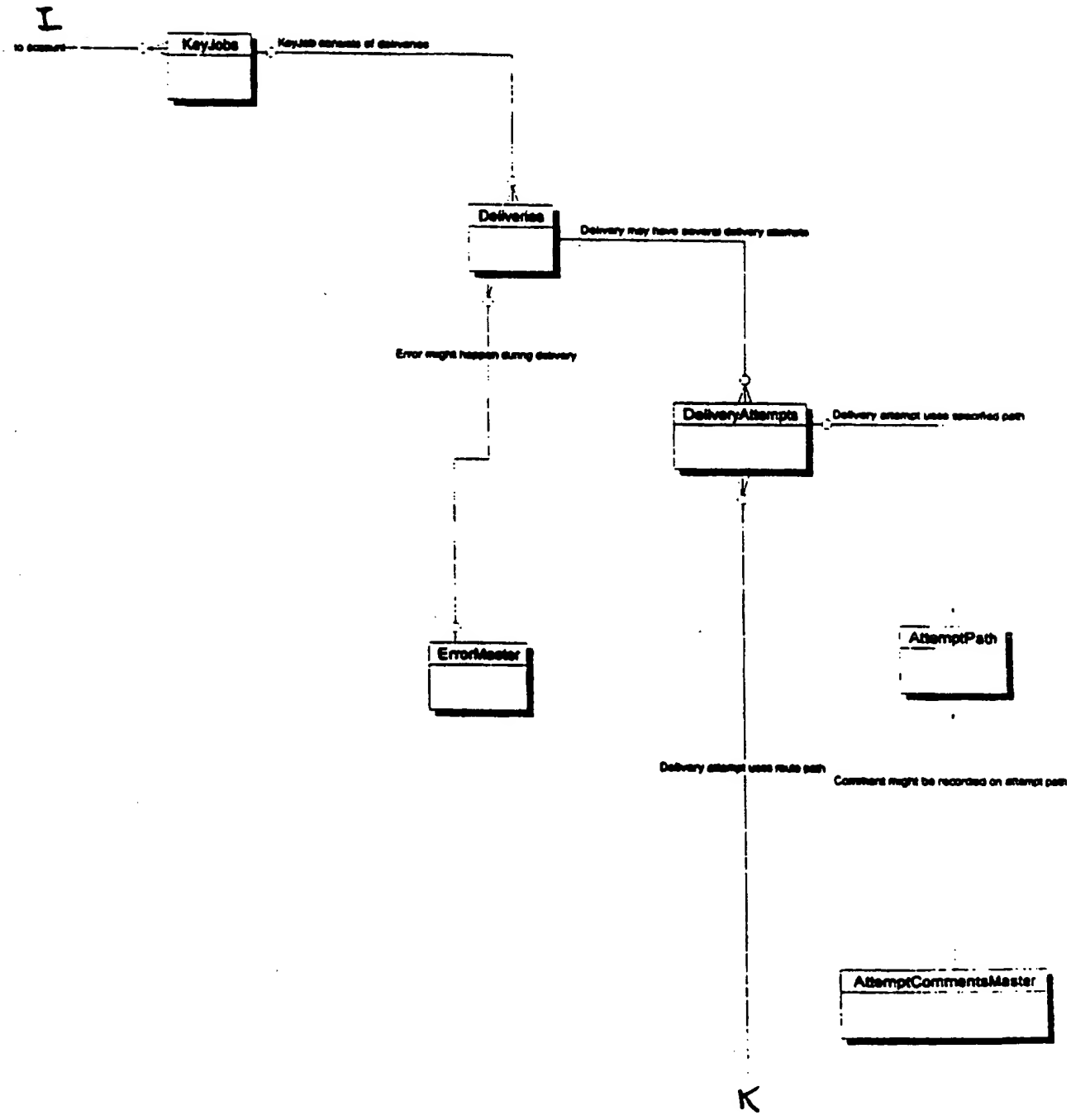

CustomerNotes
Customers
F
G
A
CustomerDepartments
B
CustomerContracts
CustomerPhones
C
D
PhoneTypesMaster
H
E
CustomerEmails
CustomerAddress
EmailTypesMaster
AddressTypesMaster


Accounts
F
G
Account has fax groups
I
AccountFaxGroups
FaxGroupNumbers

J


J
POPMaster
L
M
POP has address
POP has phone and cost structure
POPAddress
PhoneLineCost
N
POP "From" is defined in POPMaster table
POP "To" is defined in POPMaster table
O
DPOPFaxNumbers
DPOPPriorityTypes


K
RouteMaster
Send POP is defined in POPMaster table
L
M
in POPMaster table
Route has a priority type
Route consists of links
RoutePriorityTypes
RouteLinks
Link definition exists in Links table
Links
N
O
Link has cost structure
LinkCost
DiscountPolicy


I
KeyJobs
Deliveries
Delivery may have several delivery attempts
Error might happen during delivery
DeliveryAttempts
Delivery attempt uses specified path
ErrorMaster
AttemptPath
Delivery attempt uses route path
Comment might be recorded on attempt path
AttemptCommentsMaster
K

APPENDIX B

Entity information

Entity AccountFaxGroups

Description

List of fax groups per account. Fax group is a set of predefined fax numbers for fax broadcast.

Entity Accounts

Description

Contains a list of accounts per customer. A customer may have several accounts. Each account belongs to a department.

Entity AddressTypesMaster

Description

List of possible address types (for example, home, business, shipping, receiving, etc.).

Entity AttemptCommentsMaster

Description

Contains predefined list of Comments which might be inserted automatically by the system. Comments are referenced by their IDs and inserted into AttemptPath table. AttemptCommentsMaster table contains correspondence of IDs and verbal content of Comment.

EntityAttemptPath

Description

Store information about attempts path per delivery attempt. Each attempt path is a sequence of links.

Entity BillTo

Description

Contains address and phone/fax/email information of an entity which receives a bill for service provided to the Customer.

Entity CustomerAddress

Description

List of customer addresses. Cuustomer may have different addresses.

Entity CustomerContracts

Description

Contains information about details of a contract with the customer.

Entity CustomerDepartments

Description

A list of departments in customer's organizational structure.

Entity CustomerEmails

Description

List of customer e-mail addresses.

Entity CustomerNotes

Description

Contains notes per customer. There might be unlimited number of notes per customer.

Entity CustomerPhones

Description

Contains contact phone/fax numbers per customer.

Entity Customers

Description

Main record about the customer. Various sets of information about the customer are build in standalone tables related to this "main" table.

Entity CustomerTypesMaster

Description

List of Customer Types. Each Customer is assigned one type.

Entity Deliveries

Description

Contains information about deliveries per key job. In case of fax broadcast there may be several deliveries per on key job.

Entity DeliveryAttempts

Description

List of delivery attempts per delivery. In case of failures there might be several delivery attempts per delivery.

Entity DiscountPolicy

Description

Discount policy contains set of rules to define a value of a discount based on other parameter (base value).

Entity DPOPFaxNumbers

Description

Contains a list of fax numbers (country code, area code, part of fax number) and relates it to Destination POP. There might be several Destination POPs per one fax number.

Entity DPOPPriority Types

Description

Contains a list of predefined Destination POP priority types. This information plays role in selection of a proper Destination POP for a given fax number if there are several alternative Destination POPs.

Entity EmailTypesMaster

Description

List of possible e-mail types. Each e-mail address has a type (home, business, accounting dept., etc.).

Entity ErrorMaster

Description

This table contains Error codes (IDs) and verbal description of errors. Tables which store errors occurred during operation, insert only error codes predefined in this table.

Entity FaxGroupNumbers

Description

Defines fax numbers (including country and area code) in fax group.

Entity KeyJobs

Description

A table which contains information about a keyjob: an event per one key page.

Entity LanguageMaster

Description

Contains list of languages the system deals with.

Entity LinkCost

Description

Contains a structure of cost per link, based on a day, time, etc.

Entity Links

Description

This is a master table which defines a link - as a combination of FromPOP and ToPOP. The same link may be used in different route paths.

Entity PhoneLineCost

Description

Contains a structure of a phone line cost per POP based on dialled number, day and time.

Entity PhoneTypesMaster

Description

List of possible phone/fax types (for example, home, business, car, main fax, accounting dept. fax, etc.).

Entity POPAddress

Description

Contains information about POP address.

Entity POPMaster

Description

POP Master table is a central table in POP definition. Other properties of POP may exist in other tables related to this master table.

Entity RegionMaster

Description

Defines regions by phone country, area code and part of the number. Customer belongs to one region.

Entity RegionRates

Description

Contain information about cost structure in the region.

Entity RouteLinks

Description

A list of Links (from POP1 to POP2) in a route path. This list defines Route Path.

Entity RouteMaster

Description

Contains information about Route paths. This is a central table which collects references to Route paths. Route path consists Route Links. Between the same Send and Destination POPs there might be several alternative Route Paths.

Entity RoutePriorityTypes

Description

Contains List of Route Priority Types, assigned to Route Path. Priority Type plays role in selection of a proper route path among several alternatives.

What is claimed is:

1. In a computer implemented environment, there is provided a data transmission network for transmitting facsimiles which provides a subscriber with a value-added and /or lowered cost facsimile transmission, comprising:

a plurality of points of presence;

a virtual private network;

a routing and authorization processing means;

a billing and financial processing means;

wherein a plurality of sending facsimile machines and a plurality of receiving facsimile machines are connectable to any of the plurality of points of presence and wherein the user transmits a facsimile with a signaling means via the sending facsimile machine to the point of presence;

the point of presence interpreting data in the signaling means and passing the data to the routing and authorization processing means;

the routing and authorization database authorizing and routing the facsimile and passing billing data to the billing and financial processing means and wherein upon receiving routing and authorization, the point of presence routes the facsimile via the virtual private network to the destination facsimile machine.

2. The system according to claim 1 wherein, a billing and financial processing means records data relevant to the facsimile transmission for billing the subscriber.

3. The system according to claim 1 wherein, the point of presence includes an encryption means for encrypting the facsimile prior to routing and a decryption means for decrypting the facsimile prior to arriving at the destination.

4. The system according to claim 1 wherein, the point of presence includes a compression means for compressing the facsimile for transmission to the destination.

5. The system according to claim 1 wherein the transmission of the facsimile to the destination is confirmed to the subscriber by a status report transmitted to the sending facsimile machine.

6. The system according to claim 1, further including means to multicast a facsimile transmission wherein a subscriber is capable of sending one facsimile to a plurality of known destination facsimile machines.

7. The system according to claim 1 wherein, further including a broadcasting means wherein the subscriber is permitted to send the facsimile from the sending facsimile machine via the system to a plurality of unknown destination facsimile machines.

8. The system according to claim 1, further including a plurality of customized billing and reporting options selectable by the subscriber for verification of facsimiles sent via the system over predetermined period of time.

9. The system according to claim 1, further including a station to person service wherein the subscriber sends the facsimile to the system and their receiver can receive the facsimile from a preselected source other than their destination facsimile machine.

10. The system according to claim 1 wherein, further including an auditing means whereby a subscriber is capable of verifying facsimiles sent to

the system via sending facsimile machine against the facsimiles transmitted by the system.

11. The system according to claim 1 wherein, a keypage is employed to identify subscriber and destination data to the system.

12. The system according to claim 1 wherein, the data entered onto the keypage is in a format that is both readable by the subscriber and by the system.

13. The system according to claim 1 wherein, the data entered onto the keypage is in the format of a plurality of boxes placed at a predefined location and corresponding to alpha-numeric data and wherein the subscriber enters data readable by the system by shading in the appropriate boxes.

14. The system according to claim 1 wherein, the virtual private network includes a communication connection to a call-back service.

15. The system according to claim 1 wherein, the virtual private network includes a communication connection for transmission of facsimiles via an internet connection.

16. The system according to claim 1 wherein, the virtual private network includes a Publicly Switched Telephone Network (PSTN) connection for transmission of facsimiles.

17. The system according to claim 1 wherein, the virtual private network includes at least one Integrated Services Digital Network (ISDN) connection for transmission of facsimiles.

18. The system according to claim 1 wherein, the routing and authorization processing means optimizes routes based on minimal cost routing.

19. The system according to claim 1 wherein, the routing and authorization processing means optimizes the routing of the facsimile transmission for speed of delivery.

20. In a computer implemented environment, there is provided a process for transmitting data representing a facsimile at a lowered cost to a subscriber over a data transmission network comprising the steps of:

i) the subscriber sending a facsimile with a signaling means to at least one of a plurality of points of presence;

ii) the at least one point of presence processing the signaling means and transmitting the processed signaling means to a routing and authorization processing means;

iii) the routing and authorization processing means authorizing and routing the facsimile;

iv) returned the routing and authorization of the facsimile to the at least one point of presence; and,

v) the at least one point of presence routing the facsimile via a virtual private network to the destination.

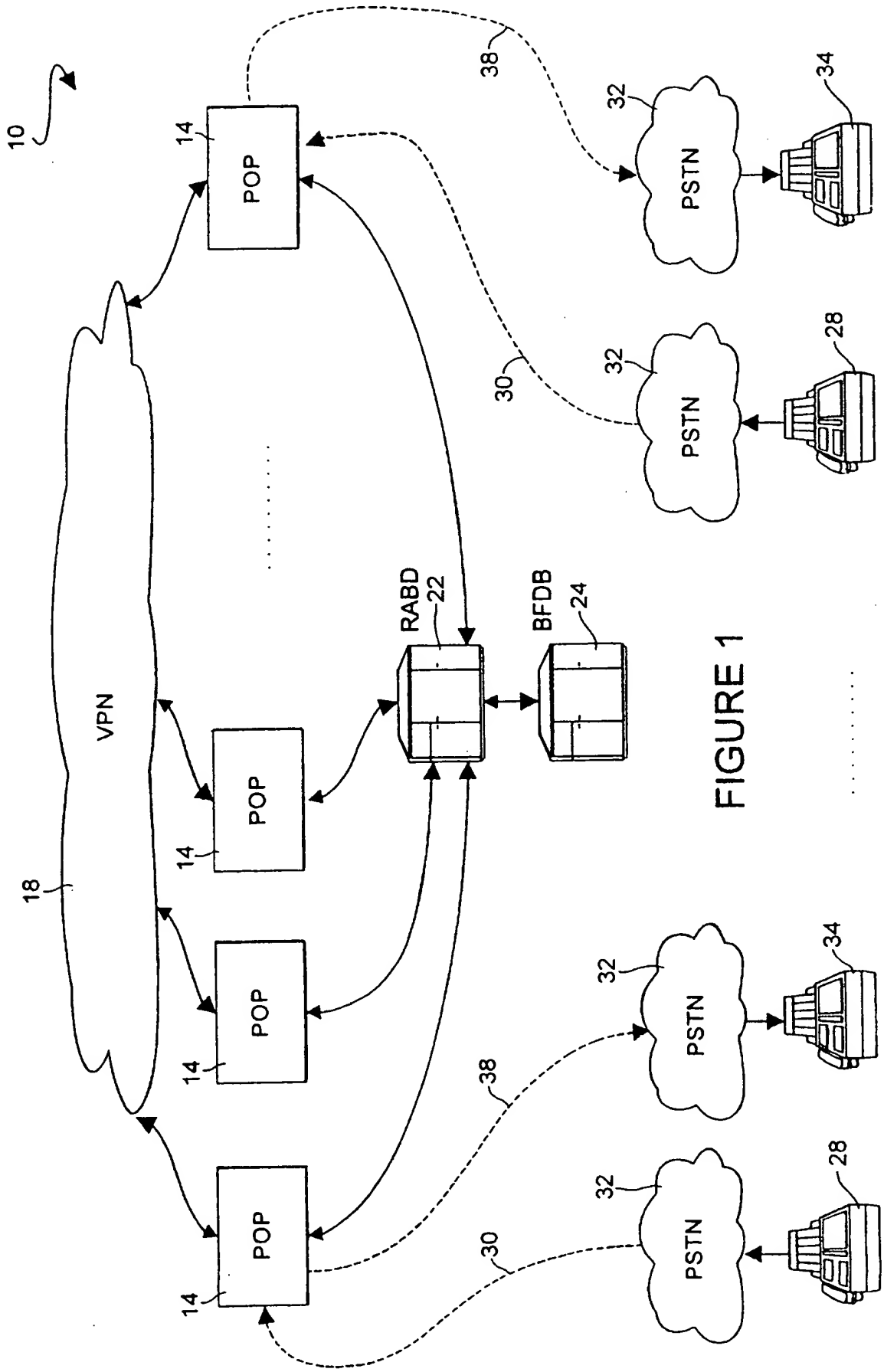


FIGURE 1

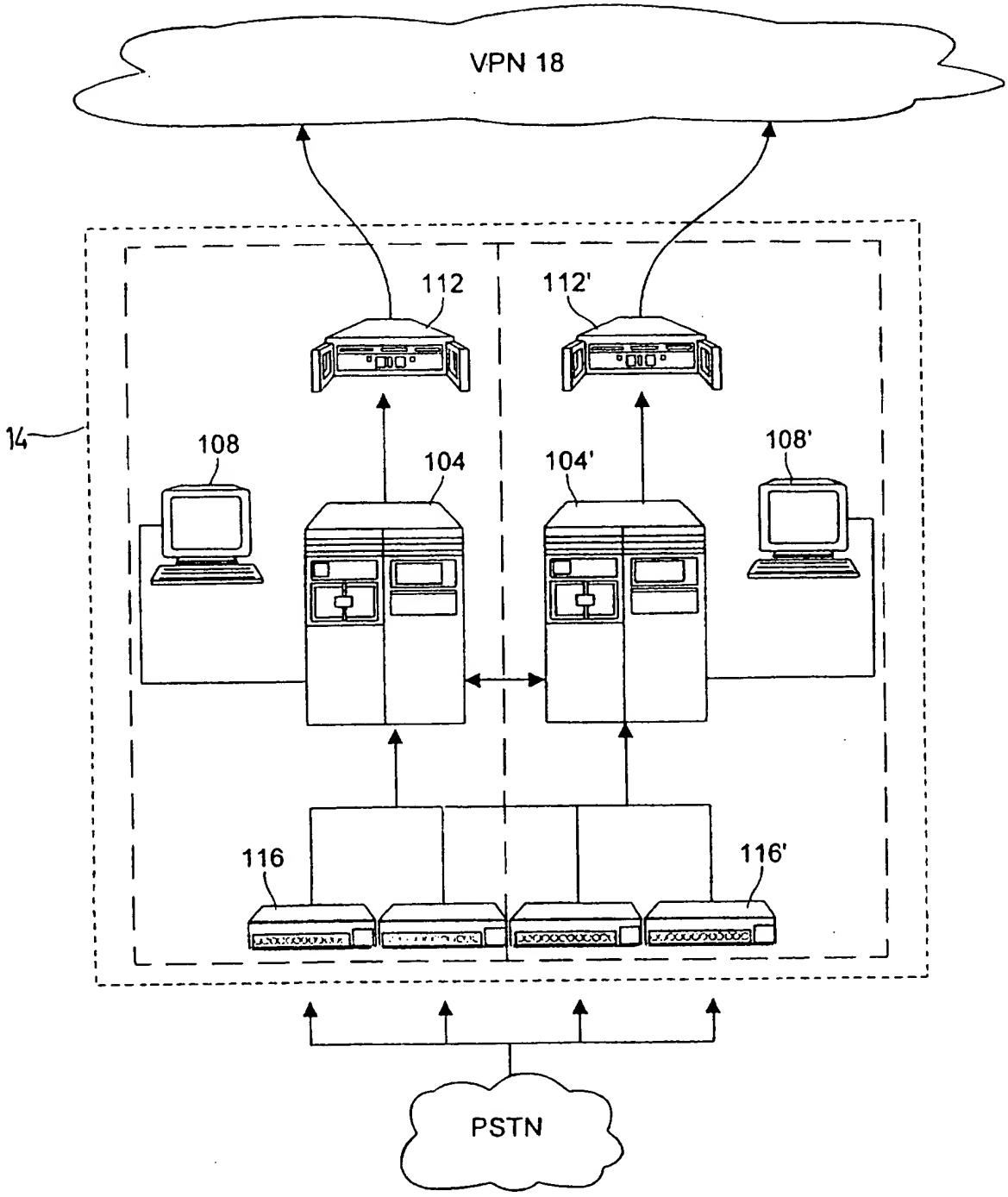


FIGURE 2

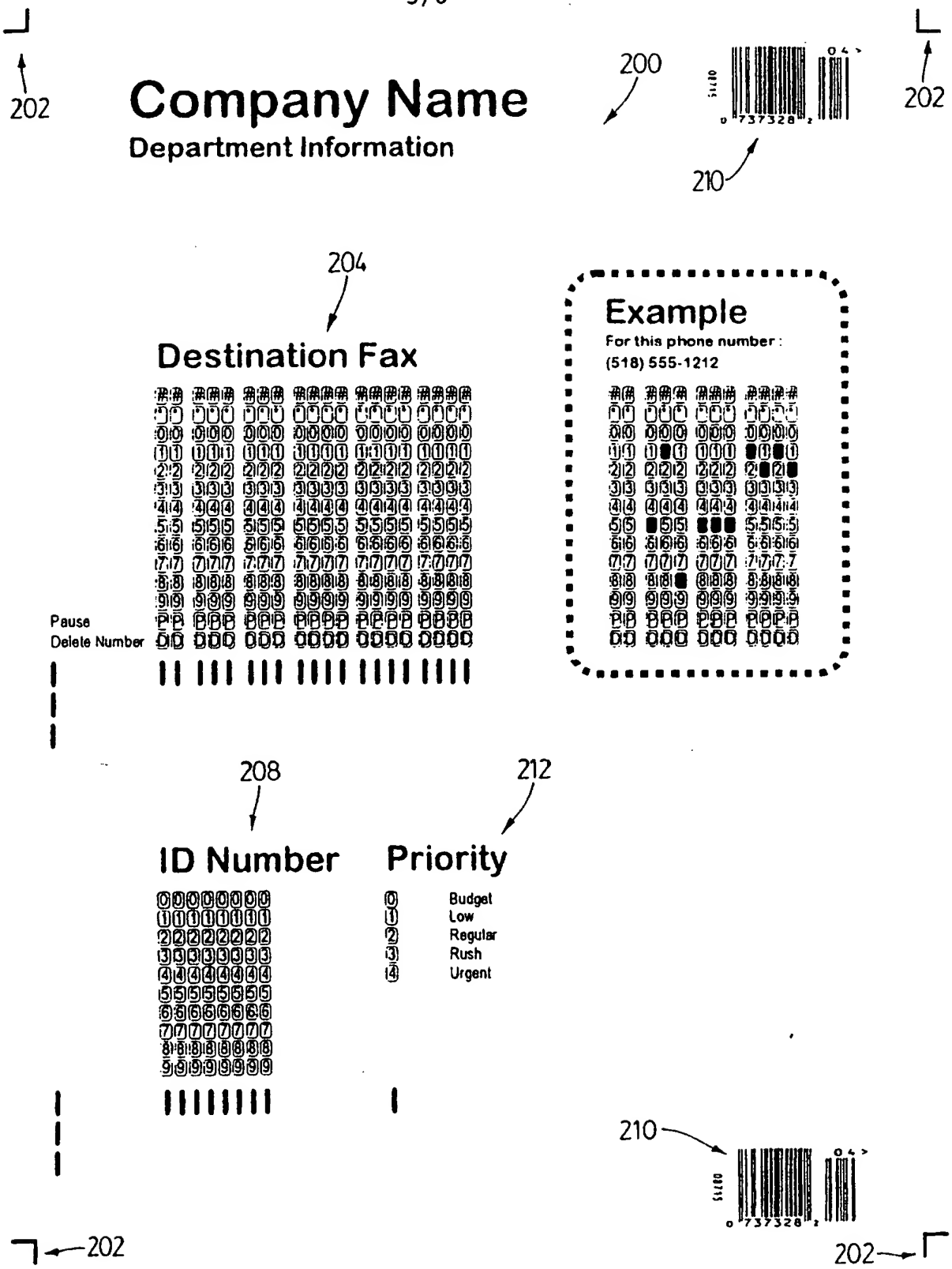

202
Company Name
Department Information
200
210
202
204
Destination Fax
Pause
Delete Number
Example
For this phone number :
(518) 555-1212
208
ID Number
212
Priority
0 Budget
1 Low
2 Regular
3 Rush
4 Urgent
210
202
202

FIGURE 3a

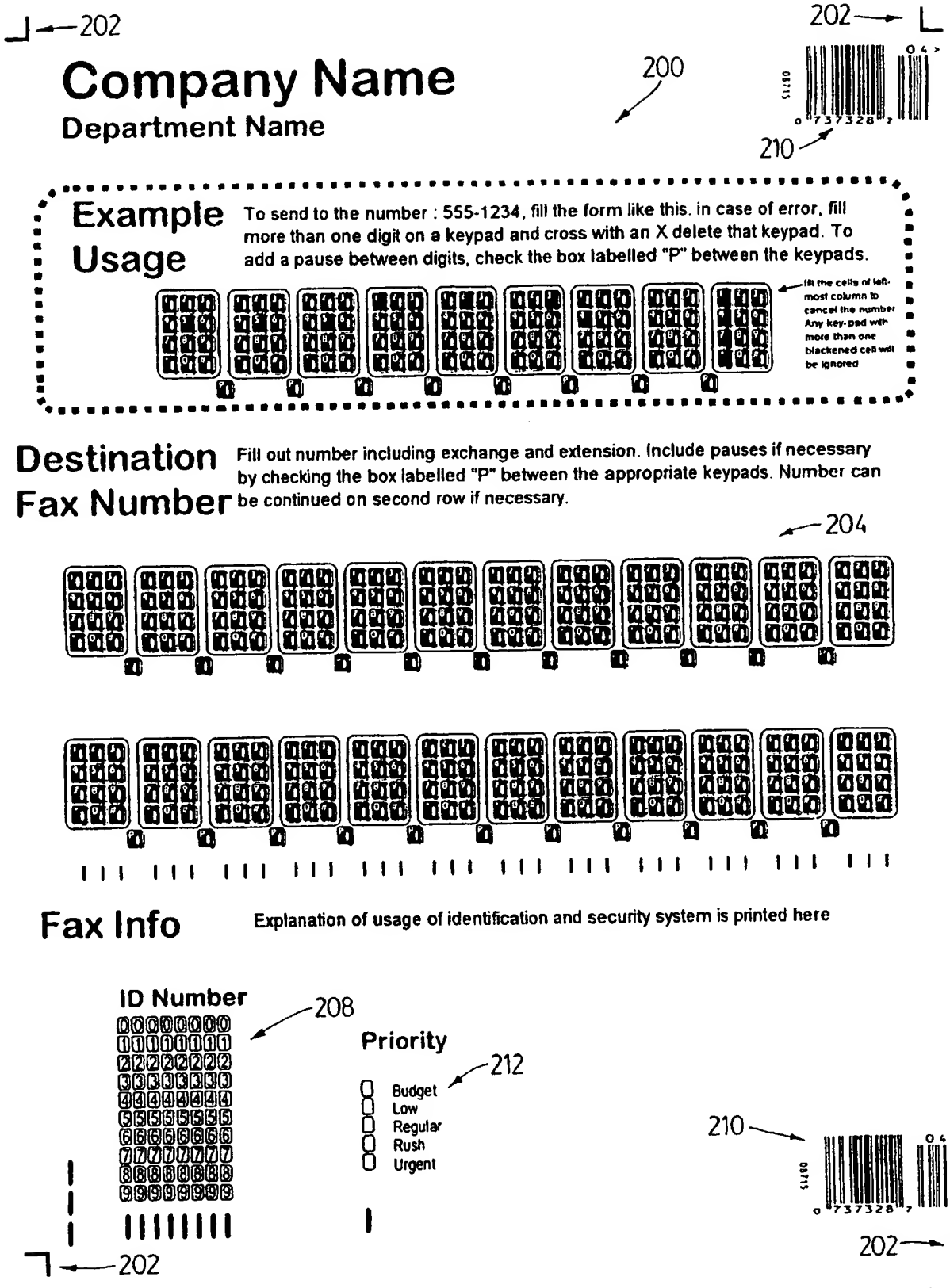

202
Company Name
Department Name
200
202
210
Example Usage
To send to the number : 555-1234, fill the form like this. in case of error, fill more than one digit on a keypad and cross with an X delete that keypad. To add a pause between digits, check the box labelled "P" between the keypads.
fill the cells of left-most column to cancel the number Any key-pad with more than one blackened cell will be ignored
Destination Fax Number
Fill out number including exchange and extension. Include pauses if necessary by checking the box labelled "P" between the appropriate keypads. Number can be continued on second row if necessary.
204
Fax Info
Explanation of usage of identification and security system is printed here
ID Number
208
Priority
212
Budget
Low
Regular
Rush
Urgent
210
202

FIGURE 3b

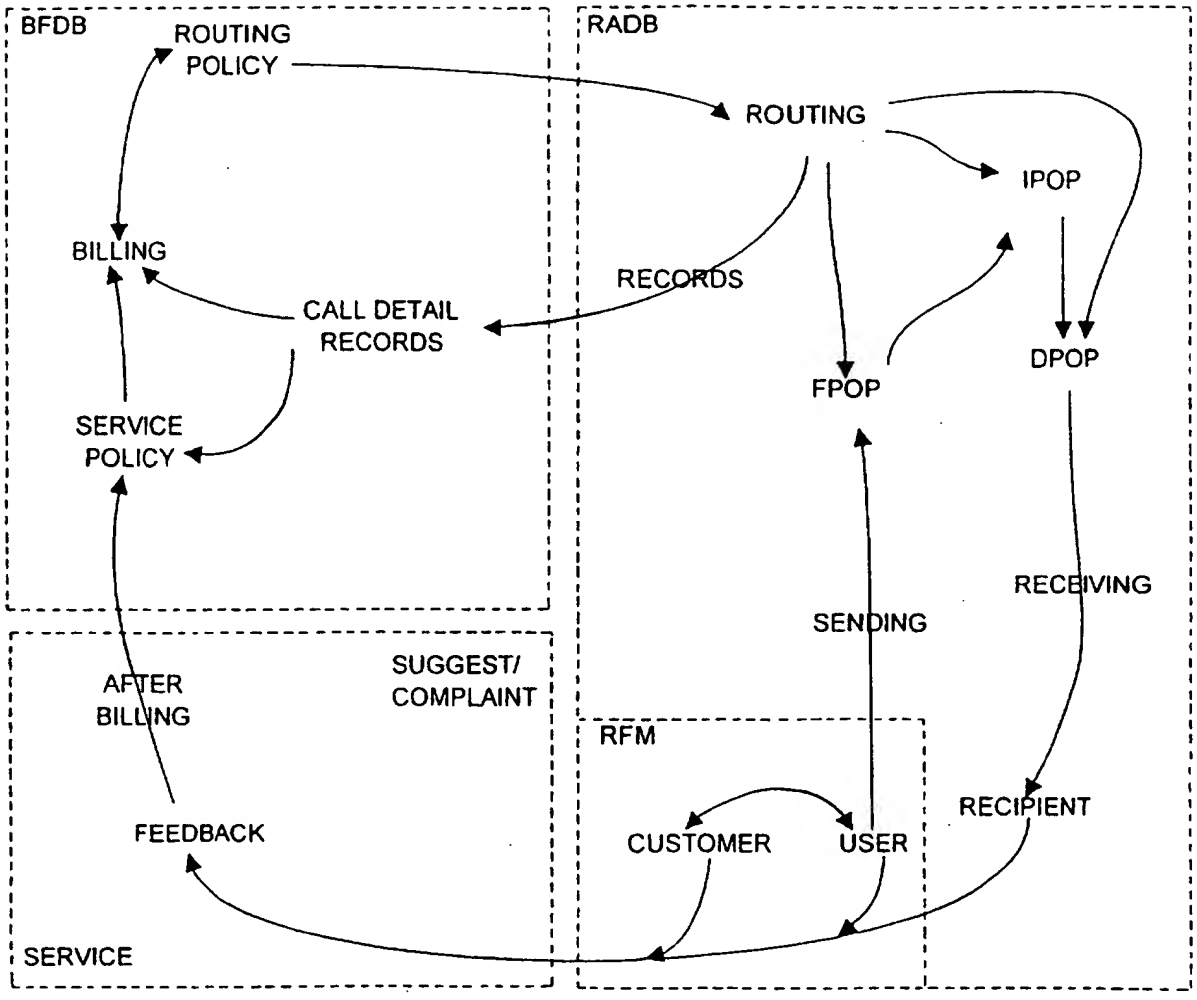

BFDB
ROUTING POLICY
BILLING
CALL DETAIL RECORDS
SERVICE POLICY
RADB
ROUTING
IPOP
RECORDS
FPOP
DPOP
SENDING
RECEIVING
SUGGEST/ COMPLAINT
AFTER BILLING
RFM
RECIPIENT
FEEDBACK
CUSTOMER
USER
SERVICE

FIGURE 4

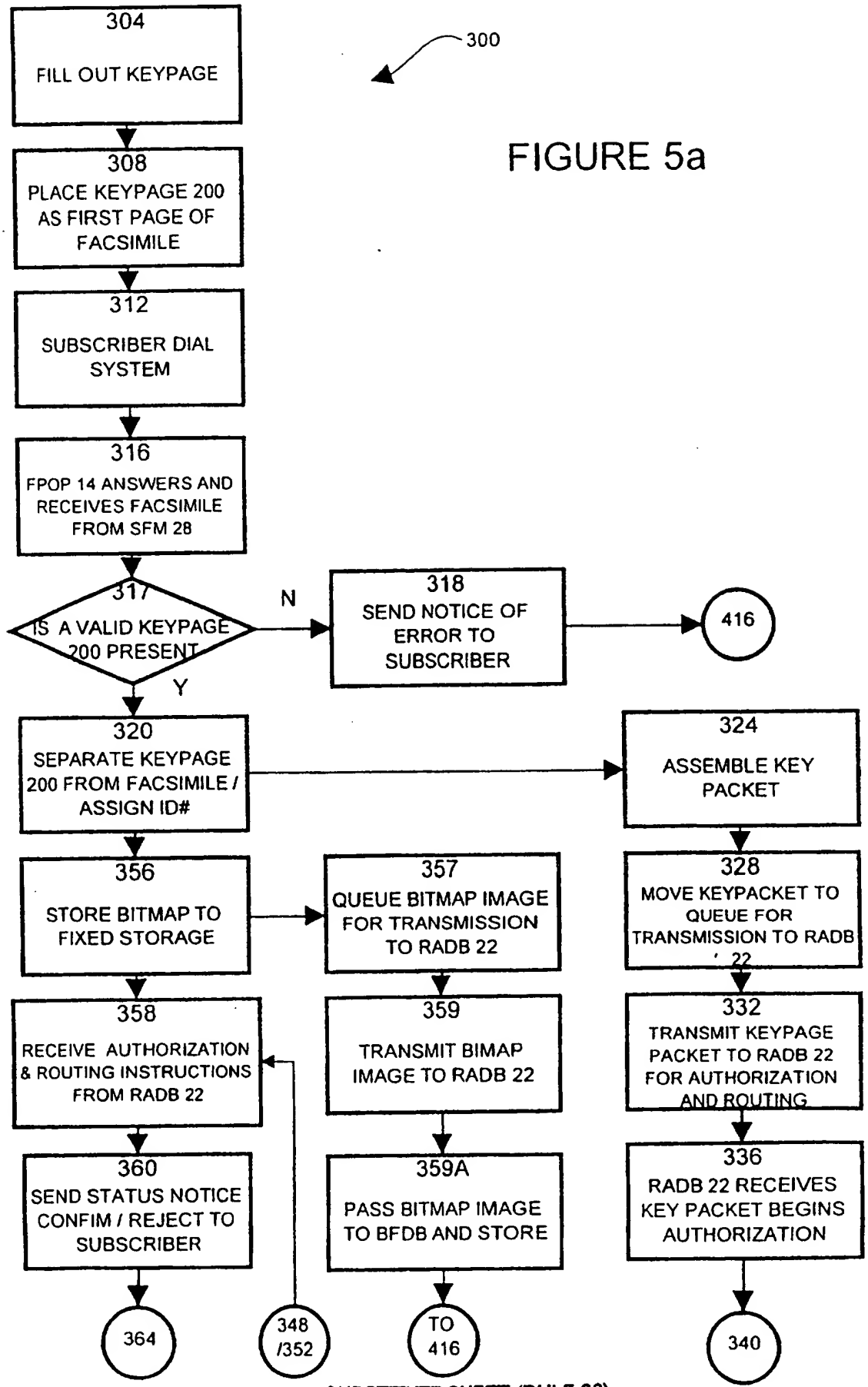

304
FILL OUT KEYPAGE
300
308
PLACE KEYPAGE 200 AS FIRST PAGE OF FACSIMILE
312
SUBSCRIBER DIAL SYSTEM
316
FPOP 14 ANSWERS AND RECEIVES FACSIMILE FROM SFM 28
317
IS A VALID KEYPAGE 200 PRESENT
N
318
SEND NOTICE OF ERROR TO SUBSCRIBER
416
Y
320
SEPARATE KEYPAGE 200 FROM FACSIMILE / ASSIGN ID#
324
ASSEMBLE KEY PACKET
356
STORE BITMAP TO FIXED STORAGE
357
QUEUE BITMAP IMAGE FOR TRANSMISSION TO RADB 22
328
MOVE KEYPACKET TO QUEUE FOR TRANSMISSION TO RADB 22
358
RECEIVE AUTHORIZATION & ROUTING INSTRUCTIONS FROM RADB 22
359
TRANSMIT BIMAP IMAGE TO RADB 22
332
TRANSMIT KEYPAGE PACKET TO RADB 22 FOR AUTHORIZATION AND ROUTING
360
SEND STATUS NOTICE CONFIM / REJECT TO SUBSCRIBER
359A
PASS BITMAP IMAGE TO BFDB AND STORE
336
RADB 22 RECEIVES KEY PACKET BEGINS AUTHORIZATION
364
348 /352
TO 416
340

FIGURE 5a

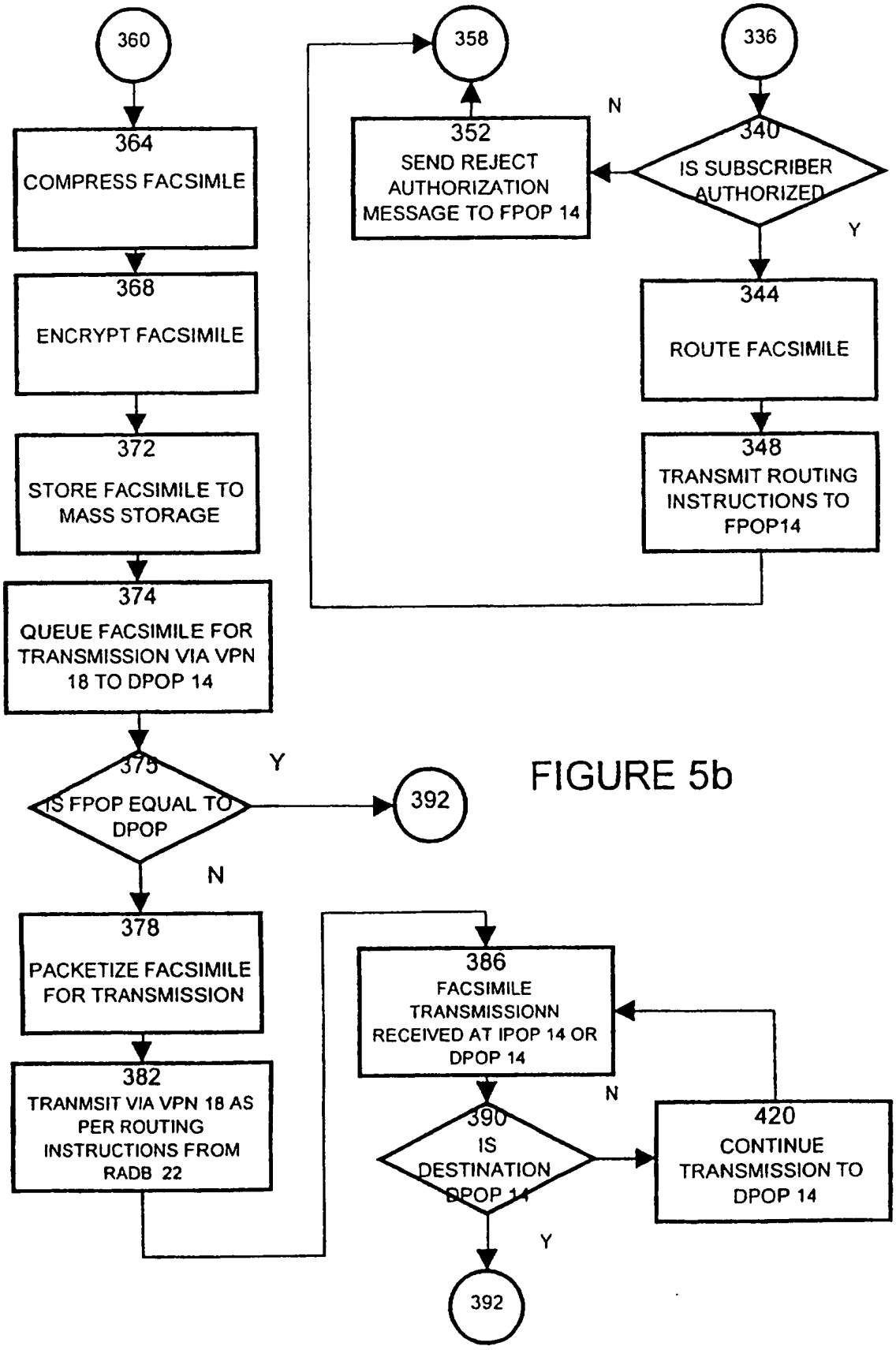
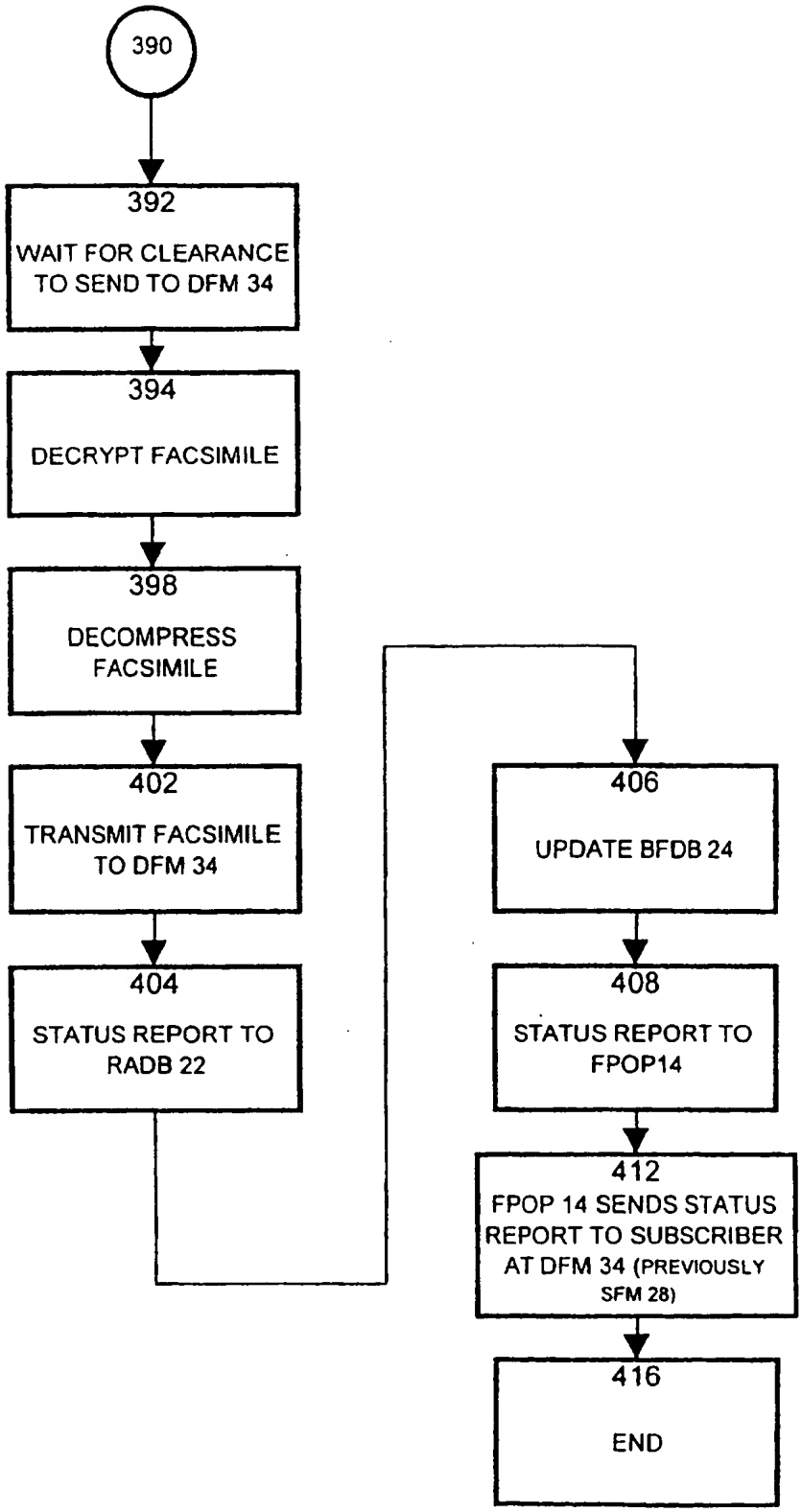

360
364
COMPRESS FACSIMLE
368
ENCRYPT FACSIMILE
372
STORE FACSIMILE TO MASS STORAGE
374
QUEUE FACSIMILE FOR TRANSMISSION VIA VPN 18 TO DPOP 14
375
IS FPOP EQUAL TO DPOP
Y
392
N
378
PACKETIZE FACSIMILE FOR TRANSMISSION
382
TRANMSIT VIA VPN 18 AS PER ROUTING INSTRUCTIONS FROM RADB 22
358
352
SEND REJECT AUTHORIZATION MESSAGE TO FPOP 14
N
336
340
IS SUBSCRIBER AUTHORIZED
Y
344
ROUTE FACSIMILE
348
TRANSMIT ROUTING INSTRUCTIONS TO FPOP14
386
FACSIMILE TRANSMISSIONN RECEIVED AT IPOP 14 OR DPOP 14
N
390
IS DESTINATION DPOP 14
420
CONTINUE TRANSMISSION TO DPOP 14
Y
392

FIGURE 5b

FIGURE 5c


390
392
WAIT FOR CLEARANCE TO SEND TO DFM 34
394
DECRYPT FACSIMILE
398
DECOMPRESS FACSIMILE
402
TRANSMIT FACSIMILE TO DFM 34
404
STATUS REPORT TO RADB 22
406
UPDATE BFDB 24
408
STATUS REPORT TO FPOP14
412
FPOP 14 SENDS STATUS REPORT TO SUBSCRIBER AT DFM 34 (PREVIOUSLY SFM 28)
416
END

INTERNATIONAL SEARCH REPORT

Inten .nal Application No
PCT/CA 97/00342

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N1/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 425 084 A (BRINSKELE EDWARD A) 13 June 1995 see column 6, line 20 - column 8, line 2 see column 16, line 61 - column 17, line 3 see column 25, line 61 - line 65 ---	1,2,18, 20
A	US 5 146 348 A (KANEYAMA YOSHINOBU) 8 September 1992 see the whole document ---	1,6,20
A	US 5 517 564 A (SLATER MARTIN ET AL) 14 May 1996 see column 4, line 17 - column 5, line 58 --- -/--	1,14,16, 20

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

2

Date of the actual completion of the international search	Date of mailing of the international search report
11 September 1997	29.09.97
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Authorized officer Hazel, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte. nal Application No
PCT/CA 97/00342

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AKIRA ISOYAMA ET AL: "PRIVATE FACSIMILE MAIL TREND" NTT REVIEW, vol. 3, no. 2, pages 26-33, XP000230750 see the whole document	1,5,6, 11,12,20

2

INTERNATIONAL SEARCH REPORT

information on patent family members

Inter. nal Application No
PCT/CA 97/00342

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		EP 0671108 A	13-09-95
		JP 8506221 T	02-07-96
		WO 9413109 A	09-06-94
		US 5553124 A	03-09-96
US 5146348 A	08-09-92	JP 4100353 A	02-04-92
		JP 4104652 A	07-04-92
		CA 2049486 A,C	21-02-92
		KR 9500759 B	28-01-95
US 5517564 A	14-05-96	AU 2895295 A	04-03-96
		CA 2195568 A	15-02-96
		EP 0772941 A	14-05-97
		WO 9604754 A	15-02-96